

VANCOUVER ISLAND/COAST REGION TELECOMMUNICATIONS STRATEGY

The Report of the Strategic Communications Subcommittee
of the Vancouver Island/Coast Innovation and Technology Task Force



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APPENDIX A: NETWORK COVERAGE MAPS & DIAGRAMS

APPENDIX B: A TELECOMMUNICATIONS PRIMER

This report presents recommendations to the Minister of Economic Development, Small Business and Trade, the Honourable David Zirnelt. It identifies the existing facilities and services available to users in the region, and outlines the current level of user needs, access to and knowledge of the services. It also provides an evaluation of strategic telecommunications initiatives undertaken in other parts of the world which have relevance to the Vancouver Island/Coast Region. From this information, recommended projects and policy initiatives are identified which will support the regional economic development and diversification of the Vancouver Island/Coast Region. The report was prepared under the direction of the Strategic Communications Subcommittee of the Vancouver Island/Coast Innovation and Technology Task Force by Intelcon Research & Consultancy Ltd.

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PREFACE

As Chairman of the Strategic Communications Subcommittee, established by the Vancouver Island/Coast Innovation and Technology Task Force, I am pleased to present this report, *Vancouver Island/Coast Telecommunications Strategy*, in the hope that it will be widely circulated, discussed, and acted upon.

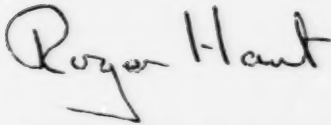
I would like to thank the Honourable David Zirnhelt, Minister of Economic Development, Small Business and Trade, the members of the Task Force, staff of both the Development Regions Branch and Technology and Communications Industries Branch, and especially the members of the Strategic Communications Subcommittee for their energy, expertise, and commitment to the future economic development of our region.

As this report and its companion *Vancouver Island/Coast Telecommunications Needs Assessment Study* documents, the Vancouver Island/Coast Region has a telecommunications infrastructure which compares favourably with other advanced countries and regions. However, the full range of network services - particularly advanced data services - derived from this basic infrastructure are not readily accessible to all advanced technology and knowledge-based industries throughout the region, nor to a number of hospitals, colleges, research establishments, schools and libraries. Even in Victoria, which is far better served than the rest of the region, different organizations use overlapping services that do not readily allow interconnection. Furthermore, although some services, such as *B.C. On-Line*, have been extremely successful, those advanced data services which are suitable to small businesses often have to be accessed by a variety of routes which are well below the level of user-friendliness and capacity that the underlying infrastructure could support.

In other jurisdictions, governments are determinedly seeking to create advantage for their own advanced technology and knowledge-based industries as well as promoting regional equality. As with the creation of the Vancouver Island/Coast Technology Centre, the Vancouver Island/Coast Region is an ideal testbed for the development of a telecommunications strategy. With decisive action now it will be possible to utilize the infrastructure that already exists in the region and demonstrate the importance of telecommunications as a tool for economic development. We have both the expertise and determination to compete in global markets.

The public sector, in partnership with industry, can provide the necessary leadership to launch our province into an exciting new era of community social and economic development. This can be achieved with limited expenditure of public funds, primarily for pilot project start-up, market stimulation and promotional purposes. This report from the Strategic Communications Subcommittee provides a concrete plan of coordination and action. All of the distinguished members of the Subcommittee who are listed on the previous page are unanimous and enthusiastic about its recommendations.

Respectfully submitted,

A handwritten signature in cursive script that reads "Roger Hart". The signature is written in dark ink and is positioned above the printed name and title.

Roger Hart, Chairman
Strategic Communications Subcommittee

EXECUTIVE SUMMARY

Global Developments

By the end of the century, two thirds of the economic activity in industrialised countries will be related to the processing, storage and transmission of information. Whether it concerns markets, prices, sources of supply, scientific knowledge, the social services, news or entertainment, information and its transmission from place to place is increasingly the commodity on which the whole economy depends.

Future prosperity is also seen to lie with diversification into new industries. The priorities set by Japan and other leading industrialized countries are to develop the micro-electronics, biotechnology, new industrial materials, telecommunications, aerospace, robotics and computer software industries. These industries are perceived to provide high value-added jobs which will contribute to high future standards of living. Even regions within the same country often compete to attract and develop the same industries.

Both these industries and the knowledge-based services they support increasingly require information networks and global connectivity. Around the world, massive spending on new telecommunications infrastructures - for example, in Europe, Japan, Singapore and the USA - reflects the widespread conviction that the speedy development of "information highways" is essential to long-term competitiveness.

British Columbia and the Vancouver Island/Coast Region

The information technology sector currently represents British Columbia's fourth largest industry and is growing at 20-25% per annum, though still accounting for only a small percentage of total manufacturing output. The resource industries are shrinking in their relative role. Over the past ten years, the importance of small business and new enterprises in job creation has more than doubled to represent over 70% of the total. Increasingly, the new enterprises are in the services and high technology industries.

In British Columbia as elsewhere, education and training are also seen as central to the development of the new economy. Human resource programs need mechanisms which utilize and familiarize people with the latest information technologies, if new industries are to be adequately staffed, and people given relevant expertise.

The Vancouver Island/Coast Region is a microcosm of the BC economy. Within its borders are some of the most economically progressive and threatened communities. Advanced technology and knowledge-based industries must play a major role in the region's diversification and economic development, although the form of development and the application of new technology will vary from place to place. An innovative and affordable telecommunications infrastructure is, however, basic to the region's needs.

Meeting the Challenge

As a first step in the development of a regional telecommunications strategy, the Telecommunications Subcommittee of the Vancouver Island/Coast Innovation and Technology Task Force commissioned a *Telecommunications Infrastructure Needs Assessment Study*. The investigations have focused on the existing facilities and services available to users in the region, as well as on the current level of user needs, access to and knowledge of the services. An overview and evaluation of strategic telecommunications initiatives in other regions of the world were also included.

From all of the information gathered, the consultants developed a prediction of the most likely short to medium term needs scenario for telecommunications services in the region, and identified a range of marketing and policy issues. From this, a set of policy initiatives and projects which would support regional economic development and diversification were developed. The process culminated in a "Telecommunications Round Table" involving representatives from industry, research, education and government agencies in discussions on the study findings, potential strategies and project initiatives.

The Existing Infrastructure

With a few exceptions, the region possesses a telecommunications infrastructure which is broadly state-of-the-art and compares favourably with other advanced countries and regions. Modern digital facilities already serve well over 90% of the region's population. BC Tel's current construction plans will modernize most of the remaining network facilities within the next four to five years.

However, the full range of network services derived from the basic infrastructure are not freely accessible. In some places, businesses and institutions consider them to be too costly. Elsewhere, the introduction of the the most advanced services may be held back because the latest technology of telephone exchange is not scheduled for implementation for a few years. A full complement of services need to be available on a more widespread and affordable basis if the region is to fully benefit from its excellent infrastructure. The region's demography, the small size of the market and its division into government and non-government segments all contribute to the problem.

The Experience of Other Jurisdictions

The survey of other advanced countries shows that in many other national and regional jurisdictions, the same problems are recognized. Governments are aware that they can have a strong facilitating role in the development of their networks. They are actively promoting information technology and infrastructure development. Although some past initiatives have had mixed results and have not always recognized market realities, governments are determinedly seeking to create advantage for their own high

technology industries, as well as to promote regional equality. Strategies range from the highly interventionist (eg. government funded capital investments) to those aimed at encouraging the growth of marketable information technology products and services.

Study Recommendations

The Vancouver Island/Coast Region possesses many ingredients for success in the modern world economy and, in many ways, is an ideal testbed for the development of a telecommunications strategy. However, the constraints of demography and market size are unlikely to be overcome without some assertive action from government. Strong leadership is required to ensure that the available networks meet the needs of businesses and institutions throughout the region. The Provincial Government could take steps to assist more rapid take-up of information technology in the Vancouver Island/Coast regional economy.

The Government's role should be a coordinating and cooperative one, making use of its buying power and of the considerable expertise it possesses in both the BC Systems Corporation and BCnet. The recommended development strategy for the Vancouver Island/Coast Region comprises an integrated package of measures which collectively:

- ***Encourage the accelerated installation of network facilities which are fully capable of supporting the most advanced services for both government and non-government users.***

This includes cooperation and negotiation, with the BC Telephone Company, of a more rapid introduction into all key regional population centres of the new *Integrated Services Digital Network (ISDN)*. The ISDN infrastructure will result in a number of important benefits to small businesses and institutional users wishing to increase their take-up of information technology.

The infrastructure initiative should also include a strategic plan for developing a private or quasi-private data network to serve the specialized needs of institutions such as hospitals, universities, colleges, research establishments, schools, libraries and small businesses. The expansion of BCnet, which already serves these sectors in the Vancouver and Victoria areas, may be the most suitable vehicle for this purpose. The Vancouver Island/Coast region is recommended as a pilot for a provincial strategy.

- ***Increase public awareness of networking and potential economic impacts.***

A strategic showcase project is proposed, focused on stimulating the economic opportunities available through information technology in two regional communities. The focus communities should include one relatively vibrant locality, plus one of the region's more threatened communities such as Port Alberni.

The project would include establishment of special community access networks - *Community Teleports* - in each locale. These would be supported and complemented by a program which includes information technology literacy training, job retraining and job creation. All would make special use of techniques which demonstrate the beneficial use of telecommunications.

- ***Increase the range of user-ready data network market applications for business, education and government services.***

This market-oriented initiative would be focused on the introduction of new applications which will succeed commercially and which can make maximum use of currently available network services. The applications should promote increased competitiveness for small business and industry sectors, and improve the quality and efficiency of government services and government-business relationships. They would also create opportunities for regionally developed software.

- ***Improve accessibility and reduce the costs of advanced network services, particularly to less advantaged, more remote communities.***

This strategy would comprise a set of innovative marketing concepts tailored to the needs of specific communities or user groups. These include: the establishment of tele-access centres where customers could use and gain experience of available services, establishment of multi-user network access facilities (community teleports) which would lower user fees, and the offering of small information technology grants (perhaps under the auspices of the existing communications grant program) to cover the introductory costs for small business users who wish to commence networking.

The proposed strategy involves limited expenditure of public money, primarily for project start-up, market stimulation and promotional purposes. It emphasizes partnership and cooperation between stakeholders, and aims for sustainable investments in the development of network service markets. It is recommended that BC Systems Corporation play a pro-active role in at least two ways. Firstly, through innovative joint ventures with BCnet, BC Tel, and other private sector partners in the implementation of the above-mentioned initiatives, where this is appropriate. Secondly, it is proposed that the Government establish a *BC Systems Technology Grant Fund*. This would utilize Corporate dividends to support the emergence of innovative community network solutions which have developmental impact but where BC Systems' current mandate may preclude direct participation.

1.0 INTRODUCTION

1.1 The Economic Context

As global economic competition intensifies, a broad response to the challenge of competitiveness is becoming vital. The strongest recurring theme in all recent analyses is that the focus must be on the creation and attraction of high value-added jobs that contribute to a high standard of living.

All activities related to the processing, storage and transmission of information will increase in importance as the world economy moves into the "information age". This will apply in virtually all sectors of the economy, from government and social services to scientific research. Future prosperity is, however, seen to lie with diversification into new industries. The priorities set by Japan and other leading industrialized countries are to develop the micro-electronics, biotechnology, new industrial materials, telecommunications, aerospace, robotics and computer software industries.

Around the world, massive spending on new telecommunications infrastructures reflects the widespread conviction that the speedy development of "information highways" is essential to long-term competitiveness of these industries and the services they support.

The world's economy and the factors upon which success and competitiveness depend are thus changing rapidly. Countries and regions can no longer rely on traditional niches but must also change. They must compete head-on, to create and attract new industries and to win and maintain market share.

1.2 British Columbia and the Vancouver Island/Coast Region

Structurally, British Columbia's economy is changing to reflect world realities. While the resource industries are shrinking in their relative role, the information technology sector is growing at 20-25% per annum, though it still accounts for only a small percentage of total manufacturing output. Small business and new enterprises now provide over 70% of all new jobs and increasingly these are in the services, high technology and information industries.

The Vancouver Island/Coast Region is a microcosm of the BC economy. Within its borders are some of the most economically advanced and threatened communities. The advanced technology and knowledge-based industries are recognised as a driving force for diversification and economic development. An innovative and affordable telecommunications infrastructure is therefore seen, by regional strategists, as being vital to the region's development.

1.3 The Role of Government and Study Outline

The keys to success in the new economy are education, technology and productivity. Education and training are, of course, as important to the new economy as the industries themselves. Human resource programs need mechanisms which utilize and familiarize people with the latest information technologies if new industries are to be adequately staffed, and people given relevant expertise.

Governments worldwide are aware that they can have a strong facilitating role in these areas. However markets, including telecommunications markets, are becoming progressively deregulated and the need for fiscal responsibility and lower taxes to encourage growth are recognized. Thus the nature of government intervention is also changing, from one of regulation and direct support to one of cooperation and facilitation.

The Vancouver Island/Coast Region Innovation and Technology Task Force was established approximately three years ago as a cooperative venture involving the provincial government, business, locally elected officials, and representatives of educational and research institutions. Its objectives are to:

- advance telecommunications access in the region
- enhance the competitiveness of knowledge-based industries in BC, and
- provide better mechanisms for training and education

INTELECON Research & Consultancy Ltd. was engaged by a subcommittee of the Task Force to undertake a *Telecommunications Infrastructure Needs Assessment* study. The study objectives were to assess the telecommunications facilities and services available to the region, and to determine their adequacy with respect to both the existing demands and the future needs and opportunities for the region. The study was the first step in the development of a regional strategy for telecommunications infrastructure development. The investigations included:

- A *Communications Inventory*, profiling the existing status, accessibility and development plans of all major telecommunications infrastructure facilities and services in the region.
- An *Inventory of Current User Needs and Knowledge*, which established the degree of knowledge or understanding of the infrastructure services by existing and potential users, their degree of access and level of satisfaction with the services.
- An *Evaluation of Strategic Initiatives in other Jurisdictions*, where telecommunications has been used to promote economic development, for their relevance to the region.

The investigations have been fully documented in a report entitled *Vancouver Island/Coast Region Telecommunications Infrastructure Needs Assessment Study*, which is available as a compendium to this report.

The information gathered in the study was used to develop the most likely short to medium term scenario for regional telecommunications demand, and to identify a range of policy initiatives and projects which would support the region's development objectives. The study process culminated in a "Telecommunications Round Table", held in November 1991, at which the consultant's findings were presented to regional representatives from industry, research, education and government agencies. Potential strategies and project initiatives were discussed.

1.4 Report Contents

This report summarizes briefly the findings of the above-mentioned study and consultation in Sections 2 through 5. It identifies, in Section 6, the market, policy and regulatory issues influencing the BC telecommunications environment and proposes a general policy framework applicable to the region. In Section 7, a set of strategic recommendations and project initiatives is developed.

Appendix A contains a set of maps and diagrams which illustrate the geographic coverage of the most important telecommunications networks in the region.

1.5 Understanding The Report

A basic introduction to the technical terms and concepts contained in the report is provided in Appendix B. Many people find the current pace of change in telecommunications and information technology confusing. Terms familiar to telecommunications professionals are little more than jargon to the average person and the array of "possibilities" the technology now offers is often bewildering.

Appendix B is thus a "Telecommunications Primer" for those who feel the need for a quick tutorial before they read on.

2.0 THE COMMUNICATIONS INVENTORY

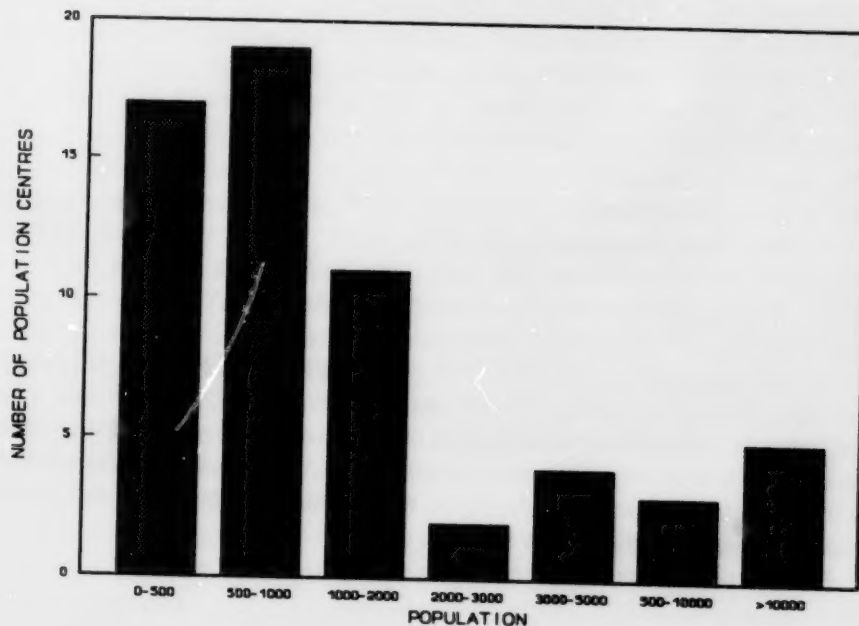
2.1 Introduction to the Region

The Vancouver Island/Coast Region currently has a population of approximately 575,000. The population density, at 6 persons per square kilometre, is extremely low by industrialized country standards, but is twice the BC average. Even so, the population is essentially concentrated in the south of the region and the eastern coastal plain from Victoria to Campbell River. Some western and northern areas, particularly the mainland portion of the region, are remote and sparsely populated.

For the purposes of the inventory, 79 localities were identified, based on their having at least one K-12 school. This, rather than population, was taken as an indicator of community socio-economic viability, in view of the importance of schools to the objectives of the study. It is estimated that more than 99% of the region's population is located in the 79 communities listed in the inventory.

Excluding Greater Victoria (almost 300,000) and Nanaimo (90,000), the average community size in the region is low, at approximately 2,600. Only seven other communities - Courtenay, Comox, Parksville, Campbell River, Port Alberni, and Powell River - have populations exceeding 5,000, as indicated in Figure 1 below.

Figure 1 - Population Distribution



The region has a varied economic base, from the predominantly government and service oriented economy of Victoria, with its significant high technology and manufacturing component, to forestry, fishing and tourism which are the mainstays of the remainder.

By far the largest employer in the region is the Provincial Government, which accounts for over 9,000 jobs (excluding the Crown Corporations) in Victoria alone. The region has approximately 500 manufacturing enterprises and up to 22,000 small businesses.

As elsewhere in North America, the fastest growing segment of the job market is that of home-based business, which includes a steadily increasing number of knowledge based and communication oriented concerns. The use of computers and fax machines in this segment is growing rapidly. The number of home-based businesses in the region is conservatively estimated at 7,000, while up to 40,000 people in the region may be classed as "self-employed".

2.2 The Networks

The network facilities and services of the telecommunications common carriers, competitive service providers and private network operators were surveyed and are described in the compendium report. Their geographical coverage was tabulated in a detailed *Facilities and Services Database*, which provides, for each of the 79 communities, the following information:

- Main network infrastructure facilities
- Planned dates for upgrade or expansion
- Telecommunications services available
- Major private network terminations & data speeds
- Cable TV subscribers
- Community population
- Number of K-12 schools
- Post-secondary institutions
- Key resource and employer industries
- Number of high tech companies

The database allowed the geographical "reach" of each network to be calculated, in terms of population coverage. It provides a relatively complete record, from community to community, of the infrastructure facilities and services available to residents of the region and will be useful for further study. The most important statistics contained in the database are summarized in the following sections.

2.3 The BC Tel Network

As the regulated telecommunications common carrier in the province, BC Tel provides universal telephone service to the whole of the Vancouver Island/Coast Region, which represents approximately 17.5% of BC Tel's total network. Of the 320,000 subscriber lines in service in the region, approximately 75% are residential and 25% are business lines.

At the present time, the technology in place and the availability of the most advanced services varies significantly from place to place. However, BC Tel has embarked on a province-wide investment program totalling \$1.6 billion over the next five years. This will include expenditures of over \$200 million for expanding and upgrading the facilities and services within the Vancouver Island/Coast Region and linking it with the rest of Canada and the world.

Penetration of Digital Facilities and Advanced Services

The trend in BC, as throughout the industrialised world, is towards the implementation of a completely digital network. BC Tel has digital *transmission systems*, extending from Victoria north to Port Hardy, with branches reaching to Port Renfrew, Port Alberni, Bamfield, Ucluelet, Tofino and several of the Gulf Islands, as indicated in the map in Appendix A. The facilities include digital microwave, copper cable and optical fibres.

Twenty of the region's more remote communities are still linked to the network by analog microwave or other types of analog radio systems. However, these together cover less than 2% of BC Tel's subscriber base, or 3% of the total population. Most will receive digital facilities by 1997.

The Victoria area has extensive optical transmission facilities. Optical systems also link Victoria to Parksville and are in place within the communities of Courtenay, Comox and Campbell River. In 1992, a dual optical ring linking the mainland with Vancouver Island and extending to the international gateway facilities at Port Alberni and Lake Cowichan, will be shared with Teleglobe, the international carrier. These can be used to provide advanced wideband services and to carry ever increasing volumes of traffic, as the network services and the demand for them develop.

The exchange *switching* technology in the region is predominantly digital, with 80% of the subscribers served from digital exchanges. Another 13% are served from offices where a digital switch is present, which means they can have digital exchange service with a simple change of their telephone number, if required. The 7% without access to digital exchange service are located in 26 of the communities surveyed.

The practical advantage of digital exchange service is the availability of advanced services such as *Custom Calling Features (SMART)*, *Business Pac*, *Faxcom*, *Remote Call Forwarding*, and the higher transmission speed at which publicly available data services such as *Envoy 100*, *iNet 2000* and *Datapac* can be accessed. Most of BC Tel's analog exchanges are the older electro-mechanical type and data speeds above 300 bits per second (bps) cannot be guaranteed (though 1200 bps may be possible). Modern digital exchanges, on the other hand, permit speeds of up to 19.2 kilobits per second over a telephone line. The majority of data service customers today are using data speeds in the 2.4 to 9.6 kbps range.

Low data speeds mean longer transmission times, which can become costly to users in remote communities if they have to pay long distance charges to access the data services. This is the case in most of the 26 communities that are without digital exchange service.

Private Line service, which customers can use for dedicated network applications at data speeds of up to 19.2 kbps, is available in almost all localities surveyed. However, in addition to the local termination charges of around \$90 per end, the distance related costs of inter-community circuits (eg. almost \$700 per month between Victoria-Nanaimo, rising to \$1,300 between Victoria-Port Hardy) are considered by many potential customers to be prohibitive.

The fully digital data services such as *Dataroute*, *Megaroute* and *Megastream* are more expensive than private line service, at the present. Although technically feasible in all locations served by digital transmission systems, they are currently tarified in only 9 regional communities. The small market size has hindered BC Tel from offering tarified service, which means that potential customers have to pay premium "special assembly" rates.

The Integrated Services Digital Network (ISDN)

The new ISDN network service will be introduced in 12 BC communities, including only central Victoria in the Vancouver Island/Coast Region, between mid 1992 and late 1993. The service will be accessible to approximately 70% of all business customers in these communities and will be introduced simultaneously by all the major telephone companies in North America.

The basic "narrowband" ISDN service, known as *Microlink*, will offer subscribers the relative luxury of three separate circuits, two of which will be usable for voice, data and image (video) transmission at speeds of up to 64 kbps.

The higher data speed provided by ISDN will mean that large text documents or photographic images can be transmitted in just a few seconds. With compression techniques, even rudimentary video services will be possible. The

hardware and application software will usually be purchased by the customer from third party suppliers, who will therefore have a crucial role to play in the development of this new service.

At a basic price of approximately twice the rental cost of a business line, with free local calling, ISDN promises to provide customers with a highly flexible and cost-effective means of accessing advanced information services. In many cases, it will also allow information service providers and private networks to extend their reach via the public network without the need for additional dedicated lines.

The availability of ISDN basically depends on whether or not a particular area is served by the latest switching system in the telephone exchange (in Canada, this is the Northern Telecom type DMS switch). Within the Vancouver Island/Coast Region, the following schedule for the introduction of ISDN has thus far been promised by BC Tel:

1992	Central Victoria (5km radius)
1994	Nanaimo
1995	Victoria (remainder of the capital area)

Other centres, which include Chemainus, Duncan, Ladysmith, Campbell River, Tahsis, Port Alice and Port Hardy, will have DMS switches installed by 1997. However, BC Tel has not at this point committed itself to an ISDN introduction schedule for these communities.

Several of the larger centres such as Courtenay/Comox, Port Alberni and Powell River, which could benefit from ISDN, were equipped with the previous generation GTD-5 digital switches within the last few years. These switches are not compatible with ISDN and are not slated for replacement until after 1997.

Broadband Services

High speed broadband networks, such as Victoria's *Metropolitan Area Network*, are available today, but are currently only feasible where the network users are geographically concentrated, because of the limitations of the current data protocol technology. The implementation in 1993/94 of a service called Switched Multi-megabit Data Service will provide bandwidths from 1.5 to 45 million bps, for applications such as computer-computer networking and video conferencing. The service will be implemented using a new data link technology called Synchronous Optical Network (SONET) and an advanced generation of Asynchronous Transfer Mode optical switches.

Although the market and costs of wideband services are currently uncertain, BC Tel and other major carriers are preparing for future wideband needs by laying optical fibre backbones between major centres, and metropolitan ring networks

which will support both standard public services and private networking. A broadband extension of ISDN, known as B-ISDN, with transmission speeds of between 45-140 million bps, will be on trial in Europe, Japan and the USA in 1992/93. However, the general availability of this type of service is several years away. B-ISDN will add high quality full motion video conferencing and is scheduled for introduction by BC Tel around 1995. However, this will likely be only in major centres such as Vancouver, Victoria and Nanaimo.

BC Tel would prefer to offer broadband via "virtual private network" services, which would provide users with the functionalities of private networks without the need for dedicated circuits. It would also provide the scale economies needed to support more widespread broadband services for large and small business alike. In the US, virtual networks are the fastest growing private network segment but the full scale offering of such services in the Vancouver Island/Coast region would probably require some major private network users, such as the BC government, to switch at least a portion of their total requirements from private to virtual network facilities.

2.4 Teleglobe

Canada's international telecommunications carrier, Teleglobe, provides the interconnection from BC Tel (and the other Telecom Canada carriers) and Unitel to the world's networks, excluding the USA which is handled directly by the Telecom Canada companies and Unitel.

Teleglobe operates the following facilities on Vancouver Island:

- An extensive earth station complex at Lake Cowichan, covering satellites over the Pacific and Atlantic Oceans and North America, and
- A Pacific Ocean cable terminal at Port Alberni. A new optical fibre cable, with a capacity of 50,000 voice circuits, will connect Port Alberni with the North America to Japan optical link in 1992.

Teleglobe's international switching centre, which connects all calls from BC Tel and other Telecom Canada customers to/from international destinations, is in Burnaby. In 1992, the existing transmission systems linking Teleglobe's Vancouver Island terminals to Burnaby will be replaced by an optical fibre ring network which is being constructed jointly by Teleglobe and BC Tel. This network will enter Vancouver Island, via two separate Georgia Strait crossings, at Chemainus and Qualicum, and will have considerable spare capacity, at least initially.

The international carrier business is currently undergoing deregulation. Teleglobe is not restricted to dealing only with Telecom Canada and Unitel, as the CRTC has enabled it to offer international services to customers directly.

Through its *Globedirect* range of services, Teleglobe offers businesses the opportunity to realise considerable savings on international calls, data, message and satellite services, by providing them direct access to the international switching centre in Burnaby.

At present, Teleglobe has no Vancouver Island customers on Globedirect or on any of its direct-to-the-customer services. One reason is that the benefits of being able to access the switching centre directly are cancelled by the cost of the long distance backhaul to/from Burnaby. Vancouver Island customers are thus unable to benefit from having the ocean cable and earth station facilities close by, unless Teleglobe or another reseller offers direct access to the international network on Vancouver Island.

2.5 Competitive Services

Within the Vancouver Island/Coast Region, the extent of competition for telecommunications service provision is geographically limited by the size and structure of the market. The companies which have a presence are the following:

Unitel

Unitel is BC Tel's prime competitor for private line voice, FAX and data services within Canada and to US destinations. Within BC, Unitel's facilities comprise only 10% of BC Tel's, in terms of circuit miles. In the Vancouver Island/Coast Region, Unitel has wideband analog and digital microwave systems between Victoria and the mainland and north to Campbell River. Unitel's main central offices, where it has data switches and other equipment, are in Victoria, Duncan, Nanaimo, Courtenay and Campbell River. Smaller central offices in Port Alberni, Port McNeil and Port Hardy terminate BC Tel leased lines.

Unitel's services are tarified at up to 15% less than the equivalent BC Tel service in localities where Unitel has a central office. It is possible that the number of central offices will increase if Unitel is successful in its application, currently before the CRTC, to provide competitive long distance public telephone service. However, Unitel's plans for the region are by no means certain, with or without approval of its CRTC application. In the meantime, the range of services for which Unitel can offer cost savings to users is limited to the main population centres.

Long Distance Resellers

Several companies resell leased line facilities from Unitel and the Telecom Canada companies, offering dedicated and switched services to Canadian, US and overseas destinations. They typically offer value added capabilities and discounted long distance calling rates, through the use of US carrier routing, is

one of the prime benefits offered to customers. The resellers generally have bulk leasing agreements with Unitel, particularly for the US bound circuits.

Call-Net and **INS Corporation (INSINC)** are the only resellers which have established a regional presence in the Victoria area. They are providing primarily discounted long distance telephone service to just a few customers. Volume is not high and most of their business comes from companies headquartered elsewhere with branches in Victoria. Neither company has firm plans to expand in the region.

Cellular and Mobile Networks

BC's two cellular radio networks, operated by **BC Cellular** (owned by BC Tel) and **Rogers Cantel** (owned by Rogers Communications Inc.), provide fairly extensive coverage to coastal highway and marine areas in the region. Both companies have their own digital microwave networks which provide the trunking between cell sites and to/from the central switching facilities.

The two companies basically mirror one another's geographical coverage, from Vancouver and Victoria (as far as Sooke) in the south of the region, northwards along the east coast of Vancouver Island and the Strait of Georgia to Campbell River. Coverage also reaches north of Powell River in the mainland Coast area. Expansion plans include coverage along the Island Highway as far as Port Hardy. The coverage westwards from the Island Highway is, in most cases, only a few kilometres. Inland and west coast communities are not served.

Autotel is a province-wide, non-cellular mobile voice telephone system provided by BC Tel along most of the main highways and the BC coast. Because of its use of transmitters in the "very high frequency" band and its less sophisticated control system, extensive coverage can be provided more economically than with cellular technology. It is also less expensive to use. The service is automatic and allows full roaming within the coverage area. Although Autotel does not allow a mobile to be "handed-off" between base stations during a call, as in the case of cellular, the much larger coverage area of each base station essentially obviates the need for this feature.

Autotel will continue to be the only mobile service available to remote communities in the region for the foreseeable future. However, its usefulness will decline wherever cellular can provide users with the full coverage they need and where they can make use of cellular's increasing data transmission capabilities.

Autotel has competition from a range of independent *Radio Common Carriers (RCCs)*, who provide similar voice service to dedicated clients in specific areas, such as logging companies.

Domestic Satellite Networks

Telesat, Canada's satellite owner-operator, is 50% owned by the Government of Canada and 50% by the major telecommunications carriers. It leases its satellite infrastructure or provides services to the major carriers, and offers competitive services - satellite transponder leases or complete systems including earth stations - to corporate users.

The most rapidly increasing private network application is the use of Very Small Aperture Terminals (VSATs), which can provide simultaneous data and voice services to a large number of remote sites. The banking industry, wholesale distribution and large retail chains are potential users of VSAT services. Telesat recently provided around 240 VSATs to all the Chevron gas stations in BC. In the Vancouver Island/Coast Region, Telesat has approximately five transmit/receive earth stations in addition to the Teleglobe stations at Lake Cowichan and the Chevron VSATs.

Other satellite service providers include **Canadian Satellite Communications (CANCOM)** and **Infosat**. CANCOM leases Telesat channels and provides satellite based services to customers across Canada and BC. Its prime business area is the distribution of television signals to cable TV companies. Within the Vancouver Island/Coast Region, at least 32 of the communities subscribe to at least one CANCOM channel, received directly via satellite or via a terrestrial feed. Its second business area, *Satlink*, comprises a range of VSAT and mobile satellite services for businesses requiring video, voice, data or mobile/transportable communications. The trucking, rail and marine industries are users. At present there are only a very few Satlink terminals in the Vancouver Island/Coast region.

Infosat is part of the Nexus Group of companies. It manufactures, supplies and operates VSAT based voice, data and video communications systems. In the Vancouver Island/Coast Region, Infosat has six earth stations located in Saanich, Nanaimo, Campbell River, Moses Inlet and Jenny Inlet (logging camps) and one mining site in the Coast area. Infosat has also provided a video uplink to the BC Buildings Corporation for BC Legislature proceedings.

2.6 Private Networks

All private networks in the region, with the exception of BC Hydro's and those based on satellite facilities, use infrastructure facilities leased from BC Tel and/or Unitel. The following major BC Government, quasi-Government and private networks have an extensive presence in the Vancouver/Island Coast region:

BC Systems Corporation (BCSC)

BCSC is mandated to provide shared-usage network facilities to Provincial Government Ministries and Crown Corporations. Its corporate charter *specifically bars it from serving private sector commercial organisations*, although it does support value added services - particularly information access and transactional services - which are used by the private sector to access information which is resident in Government databases. It is also able to cooperate with the private sector in projects which promote provincial development and commercial interests.

Although BCSC's market is virtually captive and restricted to the Government sector, the corporation is required to operate commercially, by pricing its services to yield a profit. It returns dividends to its shareholder, the Provincial Government. As the Government's "carrier", BCSC is in the forefront of innovation in a number of areas such as electronic imaging, data processing, Electronic Data Interchange (EDI), information storage and retrieval, and Geographical Information Systems (GIS).

BCSC currently operates three separate province-wide networks, namely:

- ***Distributed Network (DNET)*** is a packet switched data network serving 1,000 BC Government office locations which have computers, terminals, PCs, FAXs and local area networks. Approximately 70 minicomputers are on the network and up to 10,000 devices in total. In the Vancouver Island/Coast Region, DNET has main *Switching Nodes* in Victoria and Nanaimo, which are linked to *Service Nodes* in Duncan, Port Alberni, Courtenay, Campbell River and Powell River. Throughout the region there are at least 283 office connections to the network, 236 of which are in Victoria. A DNET presence was identified in only 14 locations, the most northerly being Port McNeil.
- ***SNA Net*** is based on the IBM Systems Network Architecture (SNA) and connects 20 computers and approximately 17,000 terminals in over 100 localities throughout the province. It comprises nine interconnected *Regional Network Centres*, including Victoria, and a larger number of *Secondary Network Centres*, which include Duncan, Nanaimo, Port Alberni, Courtenay and Campbell River. A total of 350 individual office

connections are made to the network in the region, with 283 of these in Victoria. The network extends to more localities than DNET, with 19 identified in the survey, and reaches as far north as Port Hardy and Powell River.

- **PROVNET** is the Government's switched voice network to which all ministries must subscribe. It has advanced digital switching and transmission facilities and approximately 40,000 subscribers province-wide, connecting all Government offices. Two large, BC Tel provided Centrex exchanges, located in Vancouver and Victoria carry most of the load. There are private branch exchanges (PBXs) in most other centres. There are over 12,500 centrex lines in Victoria and Nanaimo. Elsewhere in the region, major PBXs are located in Victoria, Duncan, Nanaimo, Port Alberni, Courtenay, Campbell River and Powell River, with BC Tel provided tie trunks from these to other centres. A total of 45 localities in the region are connected to the system.

Customer access for all three networks is priced on a usage independent basis, to suit the government budgeting requirements. The charges for DNET and SNA Net depend on location and, in the case of SNA, the network terminal requirements. The location component increases significantly with distance from Victoria. The cost of PROVNET is the same everywhere in the province.

BCSC's services in the Victoria area are delivered via both copper wire and optical fibre cables, all leased from BC Tel. Ninety-five percent of the customer access to the data networks is at speeds of less than 56 kbps. However, in the Fall of 1990, the corporation implemented a *Metropolitan Area Network (MAN)* which provides high speed (4 million bps) access to DNET and SNA Net. It is currently fully operational for four customers (Land Titles, Forests, Health, and Finance and Corporate Relations) which have high speed applications. The MAN will eventually serve over 20 government buildings in Victoria.

In 1992, BCSC will provide its government customers with connections to both the DNET and SNA networks elsewhere in BC at data rates of up to 512 thousand bits per second (kbps), for applications such as local area network interconnections. PROVNET will also be used for off-peak image transmission. This form of voice/data integration is the first step in a long term plan for an integrated single network. The government is currently developing its ideas for the future of the Government networks, which include a BCSC proposal for major investment to establish a single integrated broadband "electronic highway" to all major traffic points in the province.

BCnet

BCnet is an advanced, private data communications network linking over 40 establishments in the Lower Mainland, Greater Victoria, Nanaimo and Kelowna.

The network is owned cooperatively by its members, who are organisations and institutions in education, research and development, and the information technology industry. The network supports activities in all of these sectors and has recently begun to allow the use of the network also for purely commercial (fee generating) services. At present there are eleven members on Vancouver Island, all but one of which are in the Victoria area.

BCnet uses primarily BC Tel leased lines to provide for the interconnection of local area networks and access to computer based services linking the research and education communities throughout BC, Canada, the US, and 28 other countries by means of links between Canada's research network (CA*net) to the Internet. The services available include remote terminal access, network news, file transfer, electronic mail and free access to a wide range of archive material.

The network's hub is located at the Harbour Centre Campus of Simon Fraser University. The network provides the following interconnections from Vancouver Island:

- UVic is connected to SFU Harbour Centre via a 384 kbps high speed link, allowing connection between UVic's Ethernet and those at UBC, SFU and TRIUMF.
- Lower speed routed links carrying the Internet protocol (TCP/IP) and operate at 9.6, 19.2 and 56 kbps. They include Camosun College, Malaspina College, three government research centres, two high technology companies and the Education Technology Centre (ETC).

BCnet is planning to expand its coverage in the next one to two years and is working with the Education Technology Centre, BCSC and BC Tel to develop a province-wide schools access program. A pilot project is currently under way in the Southern Interior region. If implemented, this would ultimately allow all of the schools in the Vancouver Island/Coast region to interconnect with one another and to access BCnet services, over the next four years.

BCnet members pay the initial and ongoing hardware, software and data line costs of connection to the network, plus monthly dues which are independent of usage and based on the speed of the link to BCnet. The fees are relatively low because of BCnet's low overheads and non-profit status. If transmission speeds were increased sufficiently to accommodate imaging and other high speed applications, a significant increase in line costs would be required. Allowing the use of the network for commercial traffic should also help to generate additional revenues for expansion.

Insurance Corporation of BC (ICBC)

ICBC operates a province-wide SNA based data network. Interconnected nodes in Victoria and Nanaimo have separate connections to the corporation's host computer at the headquarters building in North Vancouver. The network provides access at 19.2 kbps to remote terminals, workstations and printers located in claims centres and agency offices, who are thus able to make enquiries, process claims and/or input new account information. Network access for ICBC claim centres and agencies is currently available in 14 localities in the Vancouver Island/Coast Region.

BC Lottery Corporation

BC Lotteries has a low speed data network connecting 2,150 terminals to its host computer at the Kamloops head office. Approximately 20% of these are located in the Vancouver Island/Coast region, in a wide variety of premises such as shopping malls, corner stores, bars or other private sector locations. Network nodes in Victoria, Duncan, Nanaimo and Campbell River have connections to Kamloops via Vancouver.

2.7 Value Added Network Services

Value Added Services are usually targeted at the communications needs of specific market sectors. They are available from BC Tel, from various information providers and service resellers, as well as through government agencies. The following three non-BC Tel value added services are particularly important examples of Government-Private Sector cooperation in the development of information technology.

BC OnLine

BC OnLine offers users self-serve access to registry information in the databases of the BC Government's Land Titles, Companies and Personal Property registries. The service is operated by BC Systems Corporation. Users can access the service by dialling into the BCSC DNET, using special local telephone numbers in communities throughout the province. The number of users has grown from just over 2,000 in mid 1989 to 12,000 currently. They include legal firms, banks and financial houses, real estate agencies, automotive dealers and general business. The service will be considerably enhanced over the next few years with the implementation of document imaging techniques by the Land Titles Office in particular, the expansion of the interactive capacity of the network, and the addition of other information sources.

BC Business Network (BCBN)

The BCBN is an electronic marketplace that aims to link producers to markets, entrepreneurs to investments, and vendors to customers. The service is operated by the BC Trade Development Corporation and provides access, via BC Tel's iNet service, to 26 different information providers in BC, Canada, the US and elsewhere. The network also includes a closed user group service called *Chamber Link*, which is accessed by all of the province's chambers of commerce.

BCBN is continually trying to make the service more useful. There are currently 3,000 subscribers to the service, including 1,600 non-government users, and 300 private sector users in the Vancouver Island/Coast region.

Teleplan II

Teleplan II is an Electronic Data Interchange (EDI) service which provides for the electronic submission of physicians' claims to the Medical Services Plan (MSP) of the BC Ministry of Health. Physicians are able to check eligibility of individual patients on-line to the MSP computer in Victoria. Access to the MSP host is via dial-up to the BCSC network, using special telephone numbers which are separate from those used for BC OnLine. The access is toll-free for centres having a population of 4,000 or more.

The infrastructure created by Teleplan II provides the basis for sharing a wide range of other information electronically. One such expansion currently at the pilot stage involves the addition of an electronic mail service which would facilitate messaging between physicians, hospitals and laboratories. The system includes pre-admission and booking data and lab results to/from hospitals, as well as access to clinical databases.

2.8 CATV Networks

Community Antenna TV (CATV) systems now provide multi-channel TV service to the vast majority of homes in BC. The cable TV industry is regulated federally by the CRTC. In the Vancouver Island/Coast Region, there are 25 CATV companies and forty four of the localities in the inventory are served by cable TV. A further nine are served by community owned cable or low power re-broadcast systems paid for under the BC Government's Communications Grants program.

The *Saltspring Island Microwave Association*, a non-profit organisation jointly owned by participating cable TV companies, operates or sponsors a system of community antennas receiving US programs off-air (on Saltspring Island), and a microwave network extending from Saltspring Island:

- to/from Rogers Cable in Victoria
- from Rogers Cable to Shaw cable in Victoria
- a backbone system and spurs to cable companies in Duncan, Nanaimo, Parksville, Port Alberni, Courtenay, Campbell River and Powell River.

Technology and Data Communication Capabilities

All CATV networks currently use coaxial cable for distribution to homes. Whereas optical fibres are being installed between major hubs in Victoria and elsewhere, to increase total capacity and quality, the cost of widespread conversion of the distribution networks would be too great to attempt in the near term.

CATV distribution networks are also configured in a "tree and branch" architecture which is capable only of one-way transmission. CATV companies will not therefore be able to offer two way telecommunications delivery in the immediate future. Techniques have been developed to allow both telecommunications and broadcast services to be offered economically over tree and branch optical networks in future. This will lay the groundwork for the eventual convergence of telecommunications and broadcasting technology. However, regulatory issues need to be addressed before the CATV and telephone company compete directly for the range of multi-media data communication services which will be feasible to the home by the latter half of the decade. Rogers Cable and IBM have recently joined forces to explore the possibilities of providing wideband multi-media services in the future.

In the meantime, television signals will be increasingly used to distribute one-way or quasi-interactive data in the *datacasting* or *teletext* mode. This technique allows the "piggy-backing" of data signals onto the main video signal and has the potential to increase the power of one-way transmission in applications such as educational TV and commercial video services. Field tests of such applications are already underway between the Knowledge Network and the Ministry of Forests. Datacasting could be used to offer new kinds of quasi-interactive network services, such as the downloading of remote databases, software programs, textbooks, magazines, financial data, news bulletin boards, catalogs and travel information, to the home or to small businesses.

3.0 INVENTORY OF CURRENT USER NEEDS AND KNOWLEDGE

3.1 General

More than 80 organisations representing ten different economic or market sectors were interviewed to determine their degree of knowledge and understanding of the current infrastructure and the services offered. Their level of satisfaction with the services, and their need for enhanced or lower cost facilities to better serve their needs were also investigated.

The research focused on questions such as:

- Which activities use telecommunications heavily?
- How does having adequate and cost-effective access to advanced telecommunications services impact business performance?
- Is the current availability and cost of service an issue?
- What new business developments or projects in each sector will alter the demand for telecommunications?
- What measures should the Government take to encourage the use of telecommunications for development purposes?

The survey sought to establish the level of usage or future demand for a wide range of applications, from FAX, electronic mail and electronic data interchange (EDI), to high speed imaging, computer assisted design and manufacturing (CAD/CAM) and videoconferencing.

3.2 Key Findings

Coverage

The survey found that BC Tel's infrastructure in the Vancouver Island/Coast Region serves most of the existing and future needs expressed by the sample of users and potential users. As noted from the *Communications Inventory*, the digital transmission and switching systems required for the full range of current BC Tel network services are available to well over 90% of the region's total subscribers. However, the inventory noted that businesses in as many as 26 small communities (representing approximately 7% of the total subscriber base) do not yet have digital exchanges. These will have to wait for up to six years to improve on very slow speed access to information services such as *Datapac*, *Envoy* and *iNet*.

Cost

Throughout the region some of the demand for more advanced services or private network facilities is effectively suppressed by user costs, which are perceived to be high. This is particularly so for communities and services where the total demand is low and where certain services are priced by one-time incremental cost estimates known as *special assembly* rather than by tariffed rates. There is effectively no competition for the supply of network facilities and services beyond the Victoria-Campbell River corridor, which is the extent of Unitel's network.

Sectoral Characteristics

The main features of the telecommunications network services market identified by the study are the following:

Government is the largest user

The BC Government currently represents by far the most dynamic segment of the regional market and is also in the forefront of new applications development. Government users are generally well served by BCSC, which provides advice to its users and is planning a major network expansion to meet future demands. These include the interconnection of Local Area Networks (LANs) and extensive use of image technology by a number of ministries over the next few years. The Land Titles Office will be the first high volume user of document imaging. Then, from 1993/94 onwards, several ministries will begin transmitting electronic map files, as the Government's new *Land Information Infrastructure*, which defines the networking standards, enters the implementation stage.

Government is a major player in the Small Business Sector

The use of information technology and telecommunications by business, especially the small business sector, is often through government promotion and encouragement. The BC Online and BC Business Network services are prime examples and further developments in the Land Registry office will deepen this process. Other proposals exist for promoting the use of information technology in Government-business relations, for example between the Purchasing Commission and its suppliers. In many cases, it seems, Government initiatives bring new approaches to business and can make the difference in seeing them adopted.

Education and Advanced Education are key users but require further policy leadership before full potential can be reached

These sectors have a relatively high level of knowledge and interest. They are existing telecommunications users, they have strong potential for more information networking, and have several major plans and proposals in process. Future developments will be influenced by strategic decisions, based on the experience of a major pilot project in the Southern Interior, to expand the use of information technology networking to schools throughout the province. Networking can benefit students (enhanced learning opportunities), the school districts (improved administration) and Government (improved service quality). However, significant up-front investment and ongoing expenditures will be required. Stronger cooperation between the Ministries of Education and Advanced Education, as well as with regional, college and university libraries, would also help to reduce the cost of networking to any one sector and would thus promote implementation.

Libraries need support in order to enhance their community role through networking

Libraries are actively trying to increase their telecommunications usage. Many feel this is the key to the survival of rural libraries and to the updating of library services in both the rural and urban setting. Many libraries currently use the *Envoy* electronic mail service for inter-library transactions, while university and college libraries use the Internet e-mail service via BCnet. Greater use of databases and other resource sharing applications could increase their demand for telecommunications, however price is a major issue. Initiatives such as the Federal Government's *Project Horsefly*, which addresses the problems of rural libraries, OLA's *Electronic Library Network*, and potential participation in the BC schools networking project will provide the needed impetus for libraries to become more significant users.

High Technology and Knowledge-based Industries have varying applications

Benefit/cost considerations dominate among both hardware and software firms. Some expressed the view that the high technology and knowledge-based firms in the Victoria and Nanaimo areas need to have better access to telecommunications networks in order to compete and grow successfully. However, many still need to be convinced of the benefits of the services already available to them. Whereas the sector generally has the potential for rapid growth in its network usage, further market development is required, through new application designs, marketing and awareness campaigns. Existing network services can meet many of the industries' current needs, though the sector will soon need to make use of more advanced infrastructure facilities if

it is to compete internationally. The new ISDN service is likely to play a significant role, particularly for small enterprises, while the continued development of wideband options and networks such as BCnet will be increasingly important for a growing group of users within the sector.

The Health Sector has growth potential

The success of *Teleplan II* and its likely expansion to include the additional applications linking physicians, hospitals, laboratories, pharmacies and other health professionals, will increase network usage across the whole sector. There will also be an application for high speed facilities for interlinking of hospital networks and for training purposes (a process already begun in Victoria), and for experiments in telemedicine in the medium term.

The Forestry Industry has more potential

The major forestry companies have extensive voice and data networks, typically linking up to 12 regional localities and with 1.5 Mbps (T1) backbone circuits to the mainland. Some will begin to use Geographic Information Systems for electronic map networking from 1993 onwards, and are also potential users of video conferencing and more sophisticated information services throughout the region. The cost/benefit justification for networking is monitored closely by the industry.

Network sharing is required in the Smaller Communities

Several users and potential users in the education and services sector, with network service applications to/from intermediate, small sized, or remote communities indicated a need for more networking. However, their actual demand for service is currently inhibited by the cost of the facilities. They would like to investigate the cost-saving potential of usage-sharing arrangements. These include small businesses, schools, libraries and North Island College.

3.3 Demand and Bandwidth

Major developments are taking place in the demand for telecommunications and information services. This is evidenced by the wide range of knowledge and usage within each sector. Currently, information networking, beyond FAX, is commonplace in only the main urban centres, primarily Victoria. The only significant exceptions are in the government, banking and forestry sectors. However, many expect this to change radically in the next three years.

Narrowband Services

In most sectors, there is considerable potential for new, business-specific applications. Over the next three years, the demand for narrowband services such as electronic mail, EDI and electronic database retrieval will grow steadily among businesses and institutions in all intermediate sized locations. In some sectors (eg, education) there is potential for these applications to spread to all communities.

In some high technology areas, voice plus image teleconferencing or video conferencing have potential. There will also be a requirement for enhanced, multi-media (particularly data and image) applications, requiring the capabilities of ISDN or equivalent within the same time frame, in sectors such as the real estate industry and amongst businesses which use BC OnLine.

Broadband

Medium and high speed (broadband) applications, requiring more than 64 kbps circuits, and in some cases more than 1.5 Mbps (T1), will become commonplace between the ten or twelve medium sized regional centres within the next three to five years.

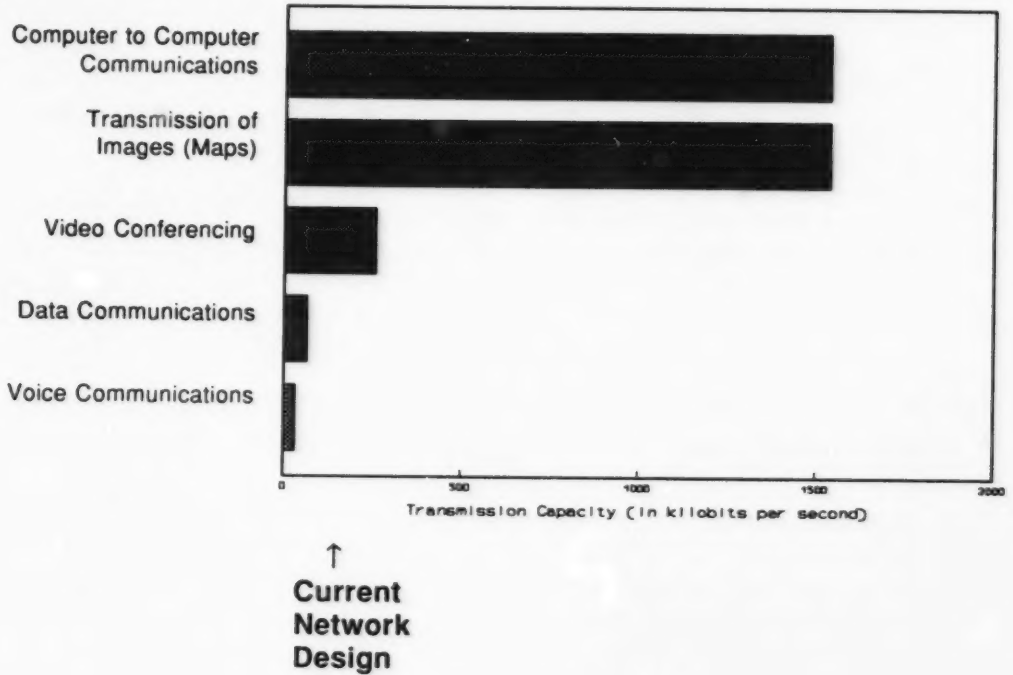
These facilities will be required to serve applications such as Geographic Information System (GIS) mapping and research file transfer, medical imaging, local area network interconnection, Computer Assisted Design and Manufacturing (CAD/CAM), and video conferencing.

Whereas the existing transmission infrastructure in the province is well capable of handling significantly more bandwidth, major upgrades in switching technology will be implemented to accomodate the new requirements, as noted previously.

However, most existing private networks in the region, except for BCSC's Metropolitan Area Network and those of the major forestry companies, operate at data speeds well below 1.5 Mbps. The impending migration to image transmission will therefore have a major impact on the bandwidth requirements of the existing networks such as BCSC and BCnet, who will need to lease more facilities.

Figure 2 (on the next page) shows the future data speeds required to provide acceptable response times on the Government networks. It indicates the magnitude of the bandwidth increases which can be expected on these networks over the next two to three years.

Figure 2 - Impacts on the Government's Networks



Source: Information Management Group

4.0 OVERVIEW OF OTHER STRATEGIC INITIATIVES

4.1 General

A wide range of published and unpublished sources was consulted to review major strategic initiatives or policies pursued by other jurisdictions, in which telecommunications have been used to promote economic development. Details were obtained of almost 40 initiatives in the European Economic Community, Sweden, Australia, Japan, Singapore and various parts of the United States. These were analyzed for their relevance to British Columbia and the region.

The *Needs Assessment Study* report contains detailed appendices tabulating the initiatives studied. Particular consideration was given to the type of jurisdiction involved (eg. national or regional); the objectives pursued; the physical, commercial and policy environment; the costs; and the specific issues identified or lessons learned.

In order to reflect the various geographic, population, and economic realities of the Vancouver Island/Coast Region, a diverse set of initiatives was studied, comprising:

- Small scale rural projects using available infrastructures
- Special purpose broadband networks for research and educational applications
- Commercially viable services using ISDN or sub-ISDN facilities

The initiatives chosen also cut across various sectors including health, research, education, business, and tourism. All of the initiatives have as a basic premise the goal of using telecommunications to assist economic development and diversity, or increased competitiveness.

4.2 Key Findings

Overview

Massive spending on new networks confirms the widespread view that the speedy development of new telecommunications infrastructure is essential to the development, long term competitiveness and evolution of new industries. This is the basic rationale for the whole range of projects, which include the European Community's *Special Telecommunications Action for Rural Development (STAR)* and its *Action on Research (RACE)* program; the USA's upgrade of the *National Research and Education Network (NREN)* and various State level education broadband initiatives; Japan's *Information Network Systems (INS)* project; and Singapore's national information technology strategy.

There is also sufficient evidence to indicate the riskiness of large scale infrastructure investments when they are made before the applications are developed or the demand established. In retrospect, a number of expensive broadband investments in France, Japan and the US are now recognized to have been misguided. But important lessons are being learned along the way and few governments or major carriers are prepared to wait passively for technological directions to be established elsewhere. Where the high cost investments are not yet feasible, low budget projects using existing infrastructures and aimed at increasing access to and knowledge of information services are also widespread.

Issues Identified

The following policy issues surfaced:

Government Support or Intervention is common to most successful initiatives.

The INS project in Japan, Minitel in France and, most notably, initiatives in Singapore have had strong government commitment and coordinated investment or regulation to encourage a chosen direction of technological evolution. This presents a challenge in regulatory environments, such as Canada's, where cross-subsidies (eg. from services to terminal equipment or from long distance to local service) are under scrutiny. In situations, such as BC's, where the instruments of regulatory policy are not in the provincial government's hand, strategies need to be particularly creative.

One area where government intervention and support can be effected and will likely be essential is in the deployment of *educational networks*. Such initiatives are not profitable ventures and so their implementation on a strictly commercial basis is not likely. Virtually all of the educational initiatives identified for this study (ie. the EEC's DELTA, the USA's ERVING, Mississippi 2000 and NREN, Scotland's Highlands and Islands Enterprise, the New Zealand distance education initiative, Canada's CANARIE, and Singapore's School Link) involve some degree of government support and intervention.

A government's need to justify its involvement in projects depends on the political environment. The centralist government in Singapore does not need to defend its interventionist methods. On the other hand, the US government's strong involvement in initiatives has had to be justified in a competitive, free enterprise environment. Federal and state governments have argued that without their involvement, no high calibre educational networks would develop since commercial enterprise could not take the necessary risk. This argument can be readily transferred to the British Columbia environment.

Demand for new services and facilities is difficult to identify and quantify. Consequently, policy must be developed with limited knowledge of either the need for services or the economic benefits accruing from them. In many cases, the promotion of information based services and facilities is key to their eventual take-up by potential users.

Many of the projects being undertaken result from a "technology push" stance. Most are being carried out without any true indication of the demand for the services or facilities being provided. Currently, the speed at which new image oriented and interactive multi-media services will be taken up on a large scale is open to question. As already noted, a number of broadband investments have been misguided and it is not clear which services are likely to make a difference economically to those regions which have them first.

In some cases, services were introduced "before their time", whereas in other cases the missing ingredient was user education. It was often unclear to potential users how they could adopt or integrate information based services into their daily activities. Promotion and training in the use of services and facilities, and the provision of incentives to stimulate the use of these at the outset, appear to be very important. Where this did not seem to be needed was in the advanced technology sector, where the costs and benefits of using such services were already recognized.

The existing level of development affects a region's ability to benefit from information technology.

A lack of other infrastructural facilities, such as adequate roads and educational opportunities, or low levels of literacy, have been found to limit the effective use of telecommunications and information technology. Most remote localities in the Vancouver Island/Coast region are less hindered by lack of physical infrastructure than by the small size of the local market and in some cases by factors such as literacy. This is reported to be the case in some communities suffering from recent forest industry closures. The availability of educational and re-training opportunities, perhaps by means of telecommunications and other advanced technologies, are thus a key ingredient to participation in the information economy.

Sharing and partnering are seen as possible means of pooling demand and spreading costs amongst a number of users in the more remote areas.

This idea is the outcome of several initiatives and projects. Potential users cannot always justify taking advantage of useful services and facilities due to high implementation or usage costs. The telecommunications carriers have little incentive to offer services economically where the market is unproven and likely

to have a long pay-back cycle. The problem can sometimes be alleviated by bringing together a number of users. Whereas this does not necessarily improve the situation from the carrier's perspective, it might bring recognition of the potential demand and lead to an innovative, user-sharing and cooperative solution.

One federally sponsored study in the USA suggested that *Rural Area Networks* be created to serve the needs and demands of users in remote areas, and that they be "piggy-backed" onto Government networks in order to offer economic interconnection.

Partnering is slightly different from sharing in that it involves the cooperation and goodwill of numerous interests, such as users, service and equipment providers, and government, to make projects feasible. A good example is the Mississippi 2000 fibre optic distance education project, where government, carrier and equipment suppliers shared the cost and project promotion responsibilities.

4.3 Where Are Initiatives Headed?

Broadband versus Narrowband

Advanced telecommunications infrastructures which support the *Integrated Services Digital Network (ISDN and B-ISDN)*, plus a range of private and virtual private networks are coming into place throughout the world. In addition, special broadband networks for research and educational purposes are emerging in the USA, Europe and elsewhere. However, this does not suggest that in every situation, broadband is being implemented in the short term. Broadband developments are proceeding on the basis that, until 1995 at least, the main users will be large corporations, major research and academic institutions, and government. Although important for corporate networks, for video conferencing, and for experimenting in a wide range of special applications (such as for high quality video in education and health), caution is being shown towards general implementation.

Given the difficulties associated with determining demand, and some of the failures that have resulted because of it, a number of projects are now being geared towards responding to demand only as it materializes. In several jurisdictions, policy makers are focusing on the basic ISDN and pre-ISDN markets. Strategic activities include: funding of joint ventures to develop user-ready applications, market promotion through awareness seminars, establishment of community teleservice centres, and the provision of information technology user grants to encourage take-up and to cover initial network usage costs. All of these appear to be sensible, market oriented approaches which will ultimately result in commercial success.

Emerging Contradictions

A key lesson is that policy makers and telecommunications carriers have, over the past decade, been forced to recognise the following contradictions:

- The gap between the technological vision (of an information technology utopia) and the market place reality (the demand for it), and
- The conflicting dimensions of policy, which seem to espouse a grand infrastructure strategy while encouraging fragmentation through competition.

The competitive environment tends to fragment demand and to reduce the economies of scale which network operators and service providers could derive from a unified market. For example, an integrated fibre optic based broadband scenario is likely to be significantly delayed in many countries by the level of sunk investment in current technology, and by the emerging competition and fragmentation in service provision. In addition to the high cost of the copper plant already in place, the continued liberalisation of cellular, personal communication networks and satellite based services (VSAT and datacasting) which can offer an increasing range of voice and data services, is increasing the options available to users.

In summary, the pace of technological innovation and market liberalisation have the combined effect of encouraging competition between networks, and shorter term investment horizons by both network providers and users. These impacts are tending to outweigh the effects of industrial and technological policy.

4.4 Application to the Vancouver Island/Coast Region

There is growing evidence internationally that the use of communication networks and information services are about to gain new levels of acceptance, but their growth is likely to be erratic and significantly influenced by the commercial and policy issues described. Governments are struggling with the issue of what should be done to ensure that their particular country or region is able to take advantage of whatever benefits there are. In the end, governments see it as their job to help ensure that if telecommunications could make the difference in the economy of the 1990s, then suitable strategies to encourage take-up and the growth of demand should be put into place. Few would disagree that in the competitive environment of the 1990's, this is an entirely appropriate response.

The most interesting initiatives as far as providing examples or lessons for the Vancouver Island/Coast Region were the following:

Singapore

A sophisticated telecommunications network is being implemented with the objective of evolving Singapore into a developed information society. The government is playing a leading, highly interventionist role by providing the complete telecommunications and information services infrastructure, and forcing industries which are subject to government control to use electronic techniques. It provides a universal application gateway, via its *Teleview* national videotex service, which is essentially a graphically oriented, menu driven and user-friendly customer interface. The plan for *Teleview* is to put a personal computer, with access to electronic mail and a host of directory, educational and special purpose services into a million homes.

The Singapore case is a striking example of how a vision can be converted to practical reality through an integrated strategy. Although the political, geographical and demographic environment is completely dissimilar from BC's, the lesson of how applications can be made widely available should not be lost. For example, *Medinet*, Singapore's health network service, provides useful insights into how BC's *Teleplan II* might be developed. This is particularly relevant since *Teleplan* was originally introduced in a somewhat Singaporean fashion (effectively forced onto physicians) and has thus far been very successful.

Aspects of *Teleview* and its interleaved special applications should be seriously considered because of the ultimate need for universal, single-stop, user-friendly customer access, if information technology is to be widely accepted by small businesses.

Scottish Highlands and Islands Initiative

This regional initiative is also highly interventionist and involves developing policies and programs to counterbalance disparities which result from the market forces which determine the development of communications infrastructures. As in Canada, these liberalizing forces can have the effect that less populated and more remote regions are poorly served, compared to the larger centres which are treated to all manner of competitive services.

Some of the activities undertaken in the Highlands and Islands initiative include: presentations to local business whenever an ISDN switch is installed in the local area; pilot projects which demonstrate the advantages of the data speeds available with ISDN; sectoral studies to determine beneficial ways of using telecommunications; choosing role models and influencers in a community and assisting them in integrating the use of information technology in their activities.

One pilot project uses the full capability of ISDN to deliver information technology training to remote areas, and to compare the results with more

conventional remote training. There may be interesting lessons which could be transferred, for example, to the retraining of laid-off workers in Port Alberni and other regional locations.

Despite its interesting and very relevant focus for BC, the Highlands and Islands project has yet to receive substantive evaluation. The initiative has also been criticized as being one which throws large sums of money and technology at rural areas without due planning.

Wales Development Board

This initiative is attractive in that its aims are to identify measures and pilot projects that can be operated on the existing infrastructure, can be implemented in the short to medium term, and are low cost. The pilot project focussed on coordinating existing initiatives, setting up information centres, training, upgrading the use of information technology by the Tourist Information Centres, and the creation of tele-access centres. The scheme was deemed by policy makers to be an easy and inexpensive way to test demand and the effectiveness of specific applications in meeting this demand.

Numeris

France learned from an initiative in Biarritz that high profile, high technology initiatives can fail because of poor marketing, high tariffs, a lack of strong leadership, and a lack of real demand. Since then, Government involvement has also shifted focus to issues such as basic ISDN for small business. The ISDN strategy, Numeris, is more demand oriented than many other initiatives. It encourages private investors to join in partnerships with France Telecom, which provides a third of the costs to develop specialized services for sectors such as hospitals, travel agents, real estate agents and retailers.

The results so far seem quite positive. The take-up time for the technology is faster than in other countries, even with relatively high tariffs. This demand oriented approach is thought to fairly represent the prevailing pattern of network services development into the 1990s.

Telecottages, or Community Teleservice Centres

The Telecottage initiative in the Nordic countries, and similar concepts in Scotland and Wales, have aimed to provide small, rural communities with communal access to telecommunications, data processing and computer assisted services, to help offset the disadvantages of remoteness and rurality. This government funded initiative was part of a strategy to diversify and reduce dependency on primary industries. It is considered a success in that the

number of telecottages, and their use, has steadily increased. However, most still depend on subsidization whereas it was hoped they would become self-sufficient. The fact that they still require funding, though, is offset by the benefits which seem to accrue to the users and communities with access to such facilities.

The telecottage idea is more recently converging with the teleworking concept to develop tele-commuting work centres through which people can replace physical commuting with working at fully serviced remote community offices. These have the potential to eventually include video conference facilities and could be equally attractive to commercial or government organizations.

The Mississippi 2000 Educational Project

Several US states are developing advanced educational networks, which indicates rapid growth in the use of information technology in education. However, the benefits are by no means proven at this stage and many of the applications are in their infancy. Some initiatives have dedicated optical fibre facilities, while the Mississippi 2000 project is the first to utilize the public telecommunications network for its main applications. The initiative is quite recent and has yet to be scrutinized carefully. However, the cooperation of the various players, including South Central Bell and system suppliers, has been the key to making this initiative move ahead. Each is benefitting from the opportunity.

The Cleveland Free-Net Community Computer System

The Cleveland Free-net is the first site in the *National Public Telecomputing Network (NPTN)* in the US. It was initiated by the Case Western Reserve University as a cost-efficient means of delivering computerized information and communications services to the community. The services range from free electronic mail to information in areas such as health, education, technology, government, arts, recreation and law, which can be accessed by the general public.

Free-Net is a free public-access telecomputing service which is paid for by subscriptions and donations from private foundations, corporations, major telecommunications carriers, etc., much as public radio or TV, with the important distinction that it is not subsidized by government. One key to the economics of the Free-Net is that the system is managed by the community itself and makes use of volunteer labour. The users include businesses, schools, various levels of government, community institutions, non-profit organizations, farmers and individuals.

Free-Net currently has a user base of over 13,000 persons and is expected to grow eventually to at least 20,000 registered users in the Cleveland area. The demographic distribution includes a strong representation from middle income parts of the service area. Affiliated Free-Nets have been established in four other Ohio and Illinois communities, including one in a rural area. Other NPTN affiliated services are also in the planning stage in six other localities.

This is an example of an effective initiative that does not require intervention or assistance from government. Indications are that, if cooperatively promoted and managed, this kind of network concept could gain wide acceptance and bring experience of information services and facilities to a wide range of people.

5.0 ESTIMATION OF PREDICTED COMMUNICATION NEEDS

5.1 Introduction

The telecommunications network needs of the Vancouver Island/Coast Region will be driven by demand from the government, the small business and service industry sectors, high technology companies, health and education. Exact prediction is difficult at this stage because of the wide variation in knowledge and appreciation of networking, even within each sector. However, pointers can be derived from:

- the North American and global experience of rapid data communications development, and
- the region's economic realities, current direction of development, and linkages with the Lower Mainland, Canada, other parts of North America and the world.

A scenario for the region is therefore derived from a consideration of these basic influences on the market place.

5.2 International Growth Trends

The telecommunications service industry in North America and globally has an enormous rate of expansion, as indicated by the following statistics:

- Data communications traffic is growing at 25% per annum in most industrialized countries (compared to 7% for voice telephony), with a strong trend towards higher speed communications.
- The optical fibre market (an indication of high bandwidth requirements) is growing at more than 35% annually.
- International traffic to/from Canada through Teleglobe is growing at 25% annually. The rates are similar in all countries.
- The value of international private networking is growing at 15-20% annually. Taking price reductions into account, traffic is growing at a minimum of 25%.
- Video conferencing is growing at a rate of 100% internationally, and is established itself as a feasible alternative to travel. Major companies increasingly install video conference centres as standard facilities.

- The number of people working from home in the USA grew 38% in the 1990/91 period. Telecommuters (ie. those using modems and faxes to communicate with employers' offices) were the fastest growing segment.
- The data traffic on the US National Science Foundation Network (NSFNet) - to which BCnet provides access and is used by institutions, research and development organizations and increasingly by commercial organizations - has increased by 180% per annum (9% per month) over the past three years.

To date, the vast majority of data communications traffic has come from relatively low speed text and transactional data. This will change as image technology takes off. By 1995, as the cost of data storage plunges to 10% of its current value and the trend towards all forms of electronic documentation accelerates, networks will have to meet the demand for major increases in bandwidth. The minimum acceptable data speeds will by 1995 move from those currently possible over a voice channel (9.6 or 19.2kbps) to the ISDN standard of 64kbps.

As the benefits of transparent (ie. high speed, non blocking, non waiting) interconnection of local area networks are experienced by major corporations and government agencies, they adopt new organizational practices, which eliminate the effect of distance and the requirement for paper transmissions (eg. reports, memos, expense accounts, etc.) between offices. By the latter half of the decade, it is likely that there will be a demand for similar networking by small businesses.

LAN interconnection, video conferencing, CAD/CAM internetworking, and high definition imaging will require bandwidths in excess of 1.5 Mbps. But a great deal of development and marketing effort will be focused on the provision of ever-improving image quality, through compression techniques, at 64 kbps or less, in order to maximize the economic benefits and market take-up of narrowband ISDN and pre-ISDN technologies.

5.3 A Needs Scenario for the Vancouver Island/Coast Region

Regional Fundamentals

Considering the economic and business profile of BC, and of the Vancouver Island/Coast region in particular, a diversification process is taking place. However, the size of the data communications market is relatively small and the distribution is thus far geographically very limited, both in terms of where it occurs in the region and in terms of destination. With some notable exceptions, the region's primary links are to the lower mainland. The major resource industries, retailers and financial institutions are almost all headquartered in

Vancouver. Furthermore, the largest proportion of the Government's traffic is between Victoria and Vancouver.

The links of small business to the US and elsewhere are developing rapidly, particularly in the research and high technology sectors, though the demand for international networking has to date been limited to relatively low speed applications.

Demand for Services

The most important milestone for the vast majority of regional enterprises, until well into the latter part of the decade, will be to adopt the basic ISDN service. The few who subscribe to information services today are using relatively low data rates, thus ISDN will offer radical new strides for them. Public broadband services are unlikely to be demanded in sufficient quantity to justify their widespread implementation before 1995, unless the key potential users (eg, government, banks and forestry corporations) migrate from private to public network services, thus changing the fundamental economics of the public services market.

In view of the above, the network requirements can be summarized into two categories as follows:

Low Speed Public Network Applications, including ISDN and Pre-ISDN

The demand for narrowband applications will come primarily from:

- the companies, businesses and institutions who are currently low-volume users of private line data services at speeds up to 56 kbps
- small business and industrial users who interface with government and with the larger network users
- small businesses and teleworkers who currently have faxes and/or modems and will have a community of interest with other networking organisations and businesses.

If ISDN were fully available and marketed aggressively, a conservative estimate of the level of demand by 1995 would be almost 10,000 ISDN customers in the Vancouver Island/Coast Region, comprising ½% of residential lines (representing less than 20% of the region's home businesses and teleworkers) plus, say, 10% of existing conventional business lines. This assumes that suitable hardware and application software will be developed and become available to customers, which is a reasonable assumption over the next three to four years, in view of the emerging ISDN market in North America. Eighty percent of the region's ISDN customers would be in the Victoria area, with most

of the remainder in Nanaimo, Courtenay/Comox, Campbell River, and potential teleworker localities such as the Gulf Islands.

BC Tel's current projections are more conservative and envisage this level of penetration to be reached later in the decade. However, once the potential economic benefits of ISDN are appreciated by small business users, and widespread applications are developed for the USA and Canadian markets, take-up in BC is likely to be constrained more by *service availability* than by potential demand.

Private Network and Virtual Network Services

The requirement for domestic and international private networks in the region is more difficult to predict, since one or two major projects can change the situation radically. Also, there will likely be a trend towards the more potentially economic approach of *virtual networking*, and the use of the public ISDN service to access private networks, as an alternative to the growth of dedicated facilities. The balance of the demand will depend on relative costs.

The user survey indicates that the main demand for new or expanded private network facilities will come from:

- government (primarily via expansion of the BCSC network)
- the health sector
- schools and higher education
- a few financial, commercial and service organisations (primarily those who already have networks)
- the major forest companies, and
- segments of the high technology sector.

By 1995, medium speed, 1.5 Mbps (T1) and multiple T1 networking will be demanded by a few users in all of these sectors, but primarily in the twelve or so main population centres of the region plus the forest company division headquarters.

BCnet will have relatively healthy growth amongst schools and commercial users in the high technology sector. The widespread use of computers which have TCP/IP compatibility, and the gradual increase in user knowledge of the applications available on Internet (eg, electronic mail, network news, terminal access and file transfer) will make BCnet attractive for a number of users. Narrowband ISDN will also provide a very cost-effective alternative to the currently available offerings for medium speed local access between organizations and BCnet. As a result, 100% annual growth in the number of BCnet business/high technology industry users over the next 5 years is quite feasible, especially now that the network permits commercial services.

Implementation of the proposed province-wide schools network would provide additional growth.

6.0 POLICY ISSUES & OPPORTUNITIES

6.1 The Regional Context

The Victoria area has the desire and potential to become a world player in the information economy. This establishes the need for a telecommunications infrastructure in Victoria which is the equal of other major metropolitan areas in the advanced world. The BC Government has established economic diversification, science and technology, research and knowledge-based activities as priorities. The presence of government, a major university, other advanced education institutions, research establishments, a growing high technology industrial sector, and modern service industries constitute a significant market for network oriented products and services. However, the market is still relatively small and conservative, compared to the Lower Mainland. This, combined with the fact that it is effectively segmented into government and non-government networks, reduces the market appeal for service providers and therefore limits the range of options which have been marketed to date.

Other areas in the region also need to develop more knowledge-based businesses, if they are to remain prosperous and retain their population. However, the region as a whole is handicapped by its large size and low population density. Outside of the Victoria metropolitan area, the market for information technology reduces dramatically with population and distance. Because of this, only Nanaimo, Courtenay/Comox and Campbell River - and possibly Port Alberni, which is a borderline case - hold significant interest to the suppliers of competitive network services.

Most other communities are even more severely handicapped by distance and economic peripherality. Communities such as Port Hardy and Powell River (as well as Port Alberni) are heavily at risk from traditional, single industry closures and have urgent need for retraining and new industry employment. However, they are among the least likely, in the short to medium term, to have access to the full range of services which could allow them to participate competitively in the information economy. One of the factors inhibiting knowledge-based business in these communities is the relatively high cost of communications facilities and services.

6.2 Development, Telecommunications Regulation and Government Policy

In the European countries, Japan, Singapore and elsewhere, governments have sought to identify those infrastructure requirements which they consider essential to future economic development, and to take appropriate measures to ensure strategic advantage. Their policies have generally contained an element of forward vision and planning, whereas their strategies range from the highly directive approach of Singapore to that of *promoter* through the funding of awareness programs and pilot projects. The policies of the EEC and Nordic

countries, in particular, have included initiatives aimed at developing the infrastructure and economic participation of rural and peripheral regions.

In Canada, Provincial governments are faced with the challenge that even if they possess a vision, they do not necessarily control all of the means of fulfilling it. Intervention has to be balanced against the role of market forces decreed at the national level. As already noted, the pursuit of an infrastructure development strategy is often in conflict with policies tending to fragment markets through deregulation and competition. The concept of *universality of service*, originally foundational to the telephone business, thus needs to be addressed in the context of advanced services as well, since these might now be just as vital to economic well-being as the telephone was historically.

The Government should therefore concern itself with both:

- securing an advantage for BC enterprise at the leading edge, and
- achieving a measure of regional equality.

The whole region, *not just the Victoria area*, needs to become a player in the information economy. Affordable access to modern services everywhere, and their availability for education and human resource development, irrespective of location, are therefore rational policy objectives.

In facing the challenge, it is important to make the distinction between the infrastructure facilities and the network services or applications. With a few exceptions (which need to be addressed), the Vancouver Island/Coast Region is well served with basic infrastructure. BC Tel has already installed or will soon have an advanced digital transmission network throughout the region. However, this does not necessarily place the most advanced services into the hands of potential users. In many communities, the relatively small size of the market, and its fragmentation into government and non-government, appear to constrain the provision of affordably priced services to non-government users. A greater level of dialogue needs to be established between the Provincial Government, BCSC and the major telecommunications carriers, particularly BC Tel, to come up with economic solutions.

Fortunately, despite the potential for regional inequality which market liberalization has brought, CRTC policy allows a certain amount of freedom to explore creative solutions, such as user sharing and resale, in the data communications market. Within these constraints, a pro-active position by the BC Government is both feasible and desirable.

6.3 General Policy Response

Noting all of the issues raised and the viewpoints expressed by study respondents and regional participants at the *Round Table*, the consultants concluded that the region needs to have a full range of narrowband infrastructure services available on a more widespread basis. It also needs to have options for bringing broadband facilities into service as the applications for these develop.

The high cost of advanced digital facilities and the less than ideal commercial and regulatory environment for telecommunications in small markets such as the Vancouver Island/Coast Region cannot be ignored. However, steps can be taken to encourage favourable development of both the infrastructure and of the market for information services, to better meet the needs of the region. An appropriate response from the BC Government might be to:

- Provide vision and leadership to establish clear goals
- Liaise with carriers and key network operators to facilitate coordination in the response to demand
- Encourage infrastructure resource sharing in uneconomic areas
- Raise public awareness of information technology and networking through the sponsoring of various projects
- Provide financial incentives where appropriate

The Government's role in regional telecommunications development should thus strike a balance between initiatives designed to ensure the availability of an advanced public infrastructure which can meet all the existing and potential requirements throughout the region, and those aimed at stimulating the growth of demand in the region's telecommunications services market.

The Vancouver Island/Coast Region has already achieved significant momentum in government-private sector cooperation, through the work of the Regional Innovation and Technology Task Force and the establishment of the Vancouver Island Advanced Technology Centre. Also, it has a unique blend of advanced and peripheral communities contained within its boundaries. Therefore the region is well equipped to be an ideal testbed for strategic policy development, prior to the formulation of a policy framework for the whole province.

7.0 STRATEGY RECOMMENDATIONS

7.1 Introduction

This section puts forward an integrated strategy for achieving the objectives contained in the proposed policy framework. The recommended package of measures, which should be carried out concurrently, are designed to:

- ***encourage the accelerated implementation of an advanced infrastructure capable of fully supporting the new Integrated Services Digital Network (ISDN) and a range of special purpose broadband applications in regional centres***
- ***increase public awareness (particularly among small businesses) of networking and of the potential economic impacts,***
- ***increase the range of user-ready data network applications using pre-ISDN and ISDN services for business, education and government service delivery, and***
- ***improve accessibility and reduce the costs of advanced infrastructure services, particularly to less advantaged communities.***

The strategy should aim to achieve its objectives with limited expenditure of public money, emphasizing partnership between all stakeholders, and aiming for a sustainable level of investment and market development.

The following sections describe the specific measures recommended under each of the above themes.

7.2 Accelerate Implementation of an Advanced Infrastructure

This will require a cooperative understanding and negotiated agreement between the provincial government, BC Tel, and possibly Unitel, and is foundational to any regional telecommunications strategy. As previously noted, there should be more discussion and cooperation with the carriers to find ways of encouraging rapid implementation of the most advanced infrastructure and services throughout the region. The initiative should encompass two primary thrusts, as follows:

ISDN

Although most of the major switches north of Nanaimo, as far as Port Hardy, and many of the localities which currently have analog facilities, will be

upgraded to ISDN compatible technology between 1994-96, there are no firm plans for ISDN implementation beyond Victoria and Nanaimo. In addition, communities such as Courtenay/Comox, Port Alberni and Powell River, which have modern but non-compatible digital switches, are not slated for upgrading until after 1997. Potential customers have been identified in these localities and the availability of ISDN could be an important factor in their increased use of information technology.

The Government should negotiate the conditions under which all of the above could become candidates for ISDN. The Government might consider using its buying power to guarantee a minimum market for ISDN, wherever the service could fulfil a portion of its network requirements. It might also consider the option of having BCSC work with BC Tel to develop marketable Government-business applications for use with ISDN, in exchange for commitments from the carrier on the introduction of the service to specific communities.

Special Networks

Higher speed network facilities will be required to serve the special needs of users such as the University of Victoria, the colleges, the teaching and regional hospitals, research establishments (primarily in the Victoria area), and a number of high technology companies. BCnet already serves some of these, while BC Tel is currently sponsoring a wideband pilot project involving UVic and the Victoria Hospitals, which includes medical imaging and video conference teaching methods.

BCnet is planning a major expansion over the next five years and has recently decided to allow commercial services. It should be considered a potential vehicle for all of the above requirements, since the hospitals have Internet and LAN interconnect applications which BCnet could serve.

An integrated and expanded BCnet would need to have the following network infrastructure in place by 1993/94:

- A medium speed (several Mbps) backbone between Victoria and Vancouver
- T1 (1.5 Mbps) or ½T1 extension to serve regional hospitals and college campuses in Nanaimo, Courtenay and Campbell River
- Possible T1 Victoria-Internet link via Seattle
- Dial-up node providing low cost access for commercial users at the Vancouver Island Technology Centre in downtown Victoria

An expanded private network may not necessarily be the most cost-effective way forward. Parts of the requirement may be best served directly from the province's primary infrastructure through switched *virtual network* services operated by BC Tel and/or Unitel. Pre-ISDN services (ie. those using data rates between 9.6 kbps and 56 kbps) could be used to connect small businesses and other users into this virtual network.

7.3 Increase Public Awareness of Networking and the Economic Impacts

A strategic pilot program is required in order to bring key players together in the development of an effective network access model and to demonstrate new user applications. The program should have the following features:

Community Focus

The most effective and practical way of demonstrating the potential impacts of networking in the regional economy would be to focus on one or two communities which have the potential and need for economic transformation.

It is recommended that two communities become the recipients of an array of promotional, educational, business and institutional initiatives aimed at stimulating the local economy through information technology and telecommunications.

The first should be a relatively vibrant community, such as Victoria or Courtenay/Ccmox, which has a diversified economy able to make use of the initiative and to contribute expertise. The second should be a community, such as Port Alberni, which has suffered a major industry lay-off and is in need of economic regeneration.

Initiatives should be aimed at providing access to telecommunications and information services to as many groups as possible within the two communities. Planning for the program should include identifying key knowledge-based industries and services which could become economic drivers for the communities in the future. The strategy pursued and the lessons learned would serve to develop a model for more widespread implementation elsewhere.

Community Teleports

Special community access networks - Community Teleports - should be established in the focus communities. Each would provide local, toll-free access to the full range of existing public data services and to all value added services such as BC OnLine, BC Business Network, the BCnet/Internet services, and direct access to Teleglobe's international network facilities. New experimental

applications would also be developed as part of the project. One element of the project could be the establishment of a locally sponsored information network based on the Cleveland "Free-Net" model, or under Chamber of Commerce sponsorship. Schools, hospitals, libraries, municipal and provincial government agencies and businesses would be invited to participate.

It is envisaged that BCSC would work with BCnet, BC Tel, and possibly Unitel, to explore ways for the project sponsors and users to have access to the most cost-effective network infrastructure arrangements possible. The participants would also include hardware vendors, who would contribute network systems, and BC software companies.

Job Retraining

The University of Victoria, North Island College, Malaspina College, the Open Learning Agency, hardware and software companies would combine to develop a *job retraining centre*, and to make computer literacy training and video or computer assisted training available to the community.

Job Creation

BC Tel or one of the government ministries or Crown Corporations might consider a special job creation project by decentralizing a department to one of the focus communities, or to establish a tele-commuting centre. This would combat unemployment directly and heighten public awareness of the economic benefits of telecommunications. Similar steps have been taken elsewhere: for example, British Telecom moved 100 telephone operator jobs from London to Scotland; major US corporations have established data processing centres in rural localities and even overseas. The location is relatively unimportant to the employer if the skills are available and telecommunications facilities are available at a cost which allows virtual insensitivity to distance.

7.4 Develop User-Ready Applications for Small Business

The primary incentive for business and industry to use information technology is related to competitiveness. A secondary incentive, in the opinion of many, is to improve the efficiency of government-business relationships. The following are the kind of new applications which were identified as commercially viable for sponsorship or promotion under the Vancouver Island/Coast regional strategy.

It is recommended that several of these be considered for development to coincide with the *Community Teleport* proposal presented in the previous section.

Industry Group networks

There is existing potential for business-specific bulletin boards, electronic mail, and voice plus image teleconferencing among groups such as health professionals and the sub-sea R&D community. Both of these groups feel the need to share information, but the opportunities would need application development. Cooperative, market-oriented initiatives need to be pursued.

Some applications could be developed on currently available network services. The prime vehicle for enhanced multi-media applications will be ISDN. For certain R&D oriented business groups, dial-up service via the Community Teleport would provide direct access to BCnet and the Internet.

ISDN and Pre-ISDN Value Added Services

These would involve the promotion of cooperation between industry, BC Tel and possibly BCSC and BCnet, focusing on multi-media technology for specific applications, such as distance education, an enhanced BC OnLine service, or to serve specific vertical markets such as the tourist industry or the home business sector.

EDI Trial for a Specific Government-Business Application

A number of possibilities exist for an application similar to the Teleplan II physician billing system. Prime candidates are the businesses which deal with the Purchasing Commission. This could include electronic data exchange (EDI), electronic mail and electronic funds transfer.

Video Conferencing Service

A cost-effective packaged service, which could be installed relatively easily at customer premises, needs to be developed for industry, educational and institutional groups. The project would need to demonstrate savings over time and travel costs, for an assumed number of people per session. The user survey found that take-up could be significant, particularly amongst high technology firms with strong links or need for recurrent trips to the Lower Mainland. A number of potential applications also exist in the advanced education, health, and job retraining fields. Whereas BC Tel has already undertaken some development activity in this area, further collaborative effort might be beneficial.

7.5 Improve Accessibility and Reduce the Cost of New Services

The primary options for improving and reducing the price of access to network services for small businesses and institutions are the following:

Shared User Groups

Shared user groups apply to specific communities or to certain long distance data communications routes. For example, north Vancouver Island users expressed an interest in establishing a shared user network, which would allow several users to lease circuits to Victoria or within the north of the island cooperatively, own whatever multiplex and protocol conversion equipment is required and enjoy significant cost savings. The group would develop flexibly, depending on the participants.

In order to facilitate a full range of traffic routing requirements, a joint venture with BC Tel, Unitel or one of the Vancouver-based resellers would be preferable. The participation of BCSC as part of a shared-user group should also not be ruled out should the non-government demand on some routes prove to be uneconomic.

A test case for sharing might be in the proposed Province-wide schools network project. Libraries, municipal offices and businesses may be able to contribute to costs and gain services at a lower price than otherwise possible. It is recommended that the next phase of this project be implemented in the Vancouver Island/Coast Region and that a user-sharing concept be pursued, using BCnet access routers in Community Teleports, to make the benefits of economic network access available to whole communities.

Community network systems, such as the *Free-Net* concept, could have a ready application within the several mid to large sized communities of the region, but may also be feasibly extended to some smaller localities.

Information Technology Grants

To encourage the take-up of services, a government program (eg. using lottery funds) could be developed to cover the introductory costs, such as a modem, software and network access or usage charges, for small business users. They could be applied primarily to businesses or teleworkers in remote communities. The concept expands upon that of the current communications grant program, to include a technology development objective. A modest amount, say between \$300 and \$500 per new user, could be given to appropriately qualified groups or businesses.

Telecottages or Tele-access Centres

These would be physical offices, established either singly or as part of the *Community Teleport* or *Free-Net* concept, which provide a range of information technology services and facilities, plus training in their use, for a user fee. They could be linked to a college regional centre, an Open Learning Agency Community Campus (in future), a library, the Chamber of Commerce, a commercial real estate development, or a local organization such as the Vancouver Island Advanced Technology Centre.

7.6 Implementation and Finance

It was beyond the scope of this study to price the strategic initiatives. The proposals need to be refined, prioritized, costed and brought together into a formal Strategic Plan. A planning group or function should be set up, under the joint auspices of the Vancouver Island Advanced Technology Centre and the Vancouver Island/Coast Region Innovation and Technology Task Force. The group's mandate would be to establish or confirm the final priorities, to enlist support for the suggested initiatives, to determine the market and technical parameters and coordinate implementation. In the case of the advanced infrastructure initiative, further investigation is necessary to establish the feasibility of both the accelerated implementation of the public infrastructure services and of the proposal for BCnet expansion.

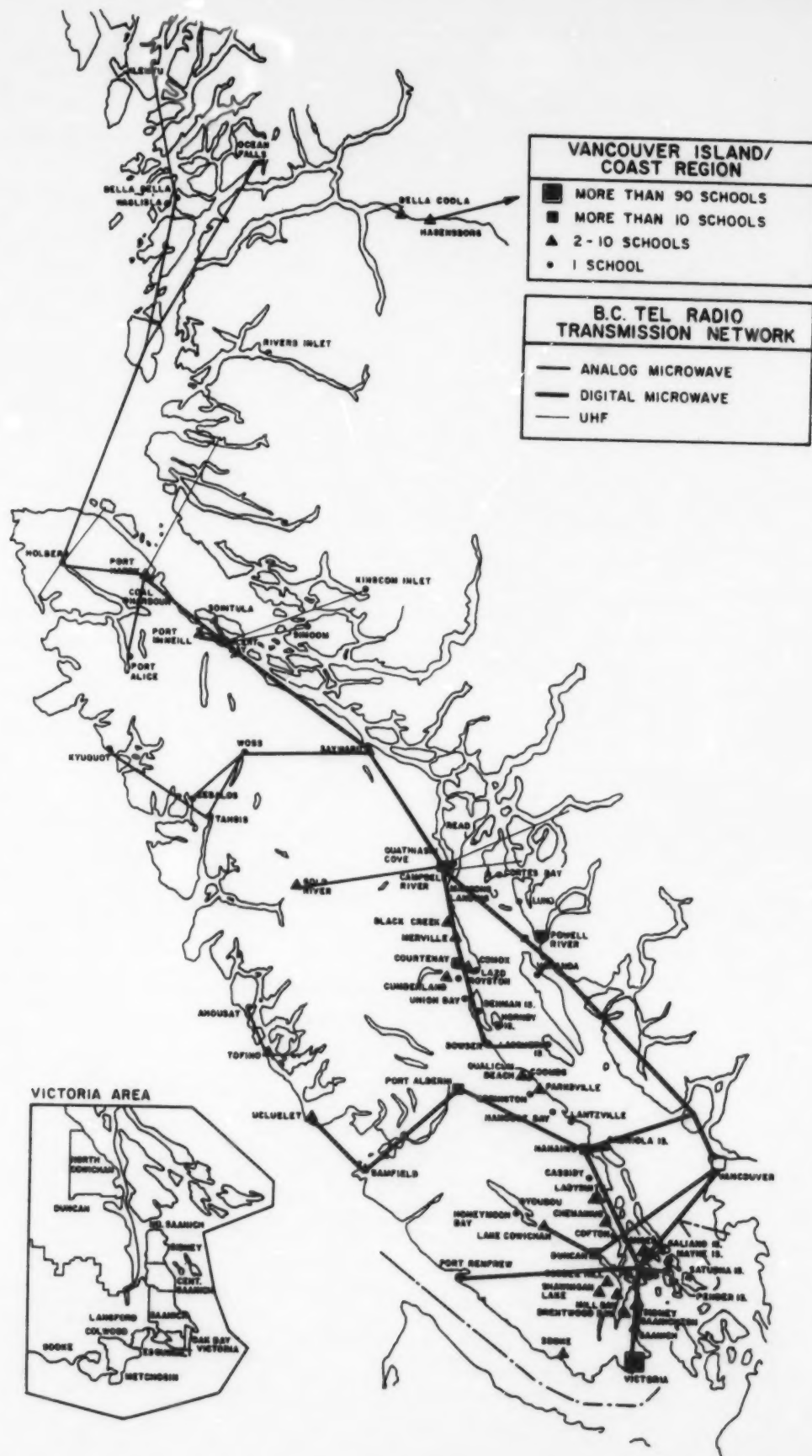
In the case of the *Community Teleport* proposal, a considerable amount of planning, coordination and project management will be necessary to establish the sponsoring partners, potential participants, user base, application designs, network parameters, costs, implementation schedule, etc.

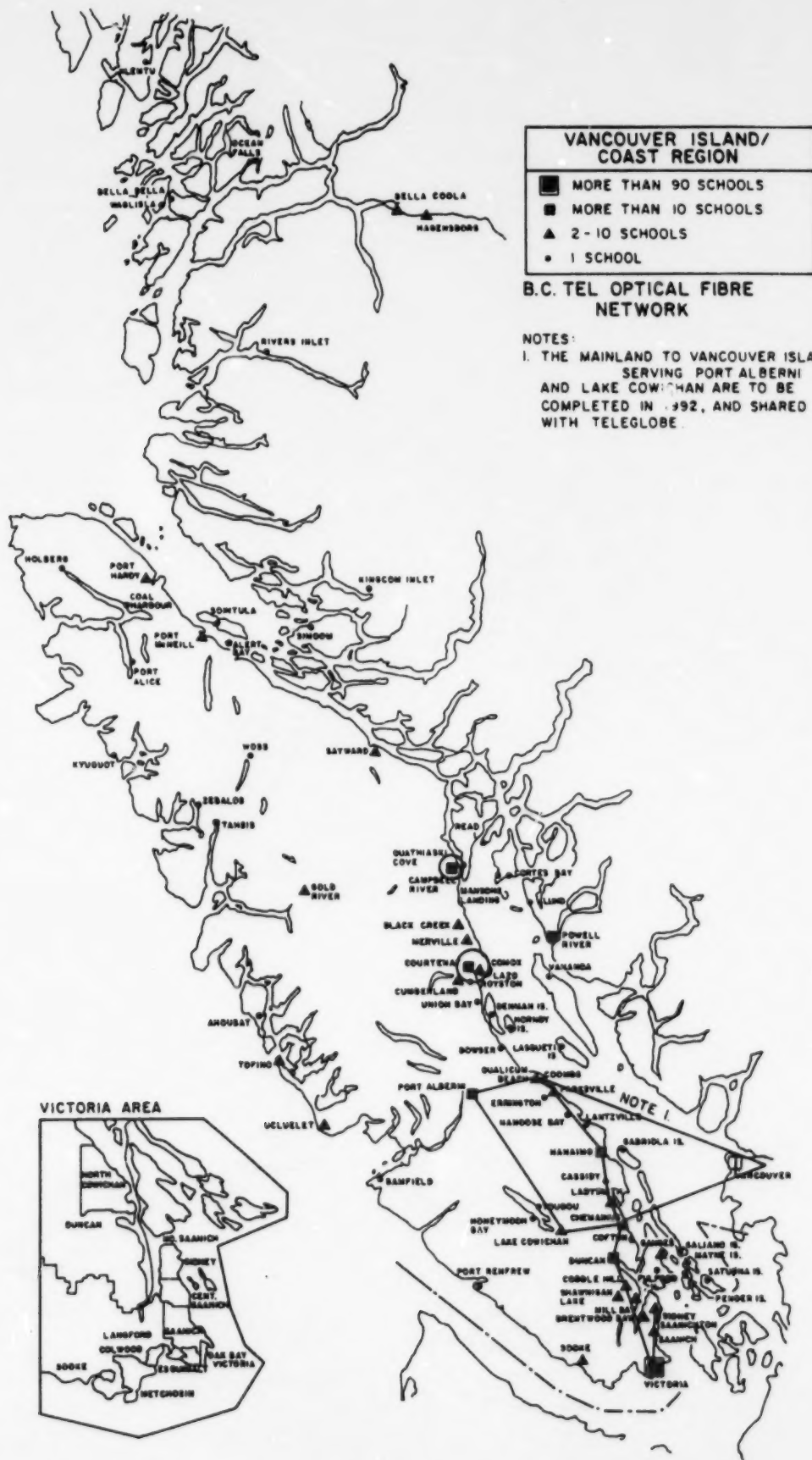
It is recommended that financial support for most initiatives should be obtained from both Government and private sector sources, in order to develop joint regional ownership and to maintain a balance between the strategic and market aspects of the proposals.

At least part of the Government support could be either through joint ventures with BCSC, or via special BCSC *technology grants*. Under its charter, BCSC is required to operate efficiently and profitably. It is therefore constrained from using its resources to promote applications or technology trials which might be of more benefit to private sector organisations than to the BC Government. However, BCSC has freedom to engage in viable joint ventures with private sector organisations in order to promote economic development in BC. It should, therefore, be able to partner with industry in the development of solutions for Government-Business applications at least.

For other scenarios, it is recommended that the Government consider establishing a *BC Systems Technology Grant Fund* for community network development purposes. A fixed percentage of the Corporation's dividends (say 50%) would be set aside to support the development of network products and services which contribute to the growth of advanced infrastructure services in the province. This fund could be considered particularly to support the growth of cost-effective and innovative network service solutions for communities and customers which BC Systems is not able to serve.

APPENDIX A
NETWORK LAYOUT MAPS & DIAGRAMS





DNET

NODE TOPOLOGY

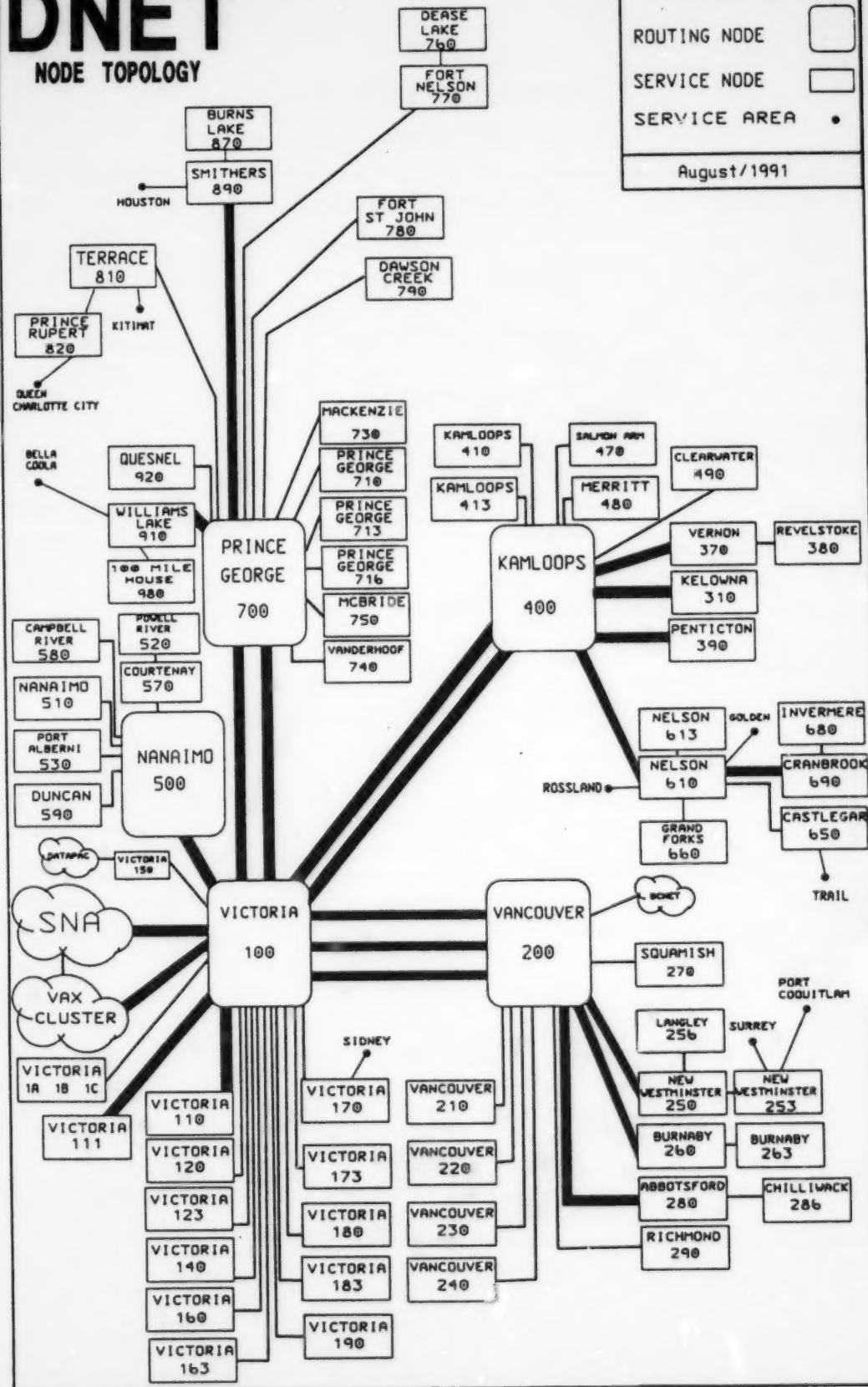
LEGEND

ROUTING NODE ☐

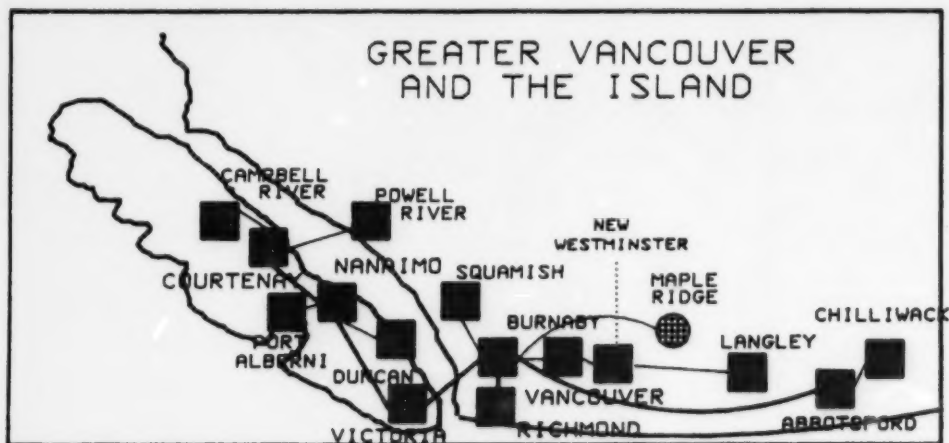
SERVICE NODE ☐

SERVICE AREA •

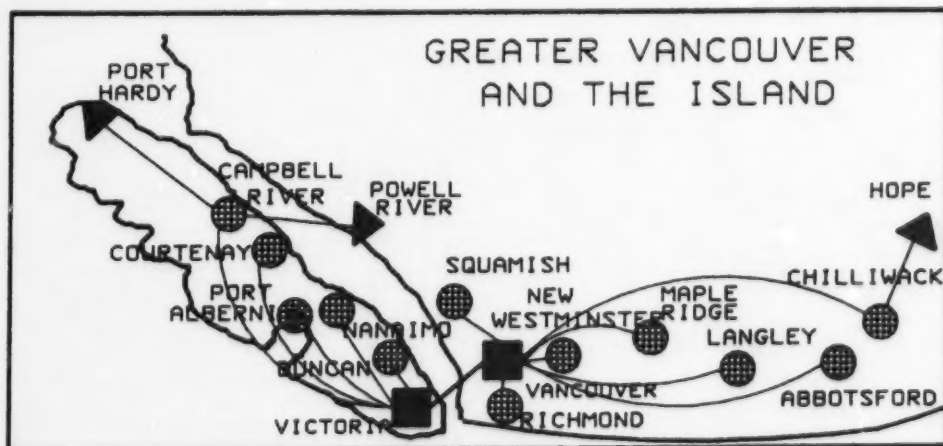
August/1991



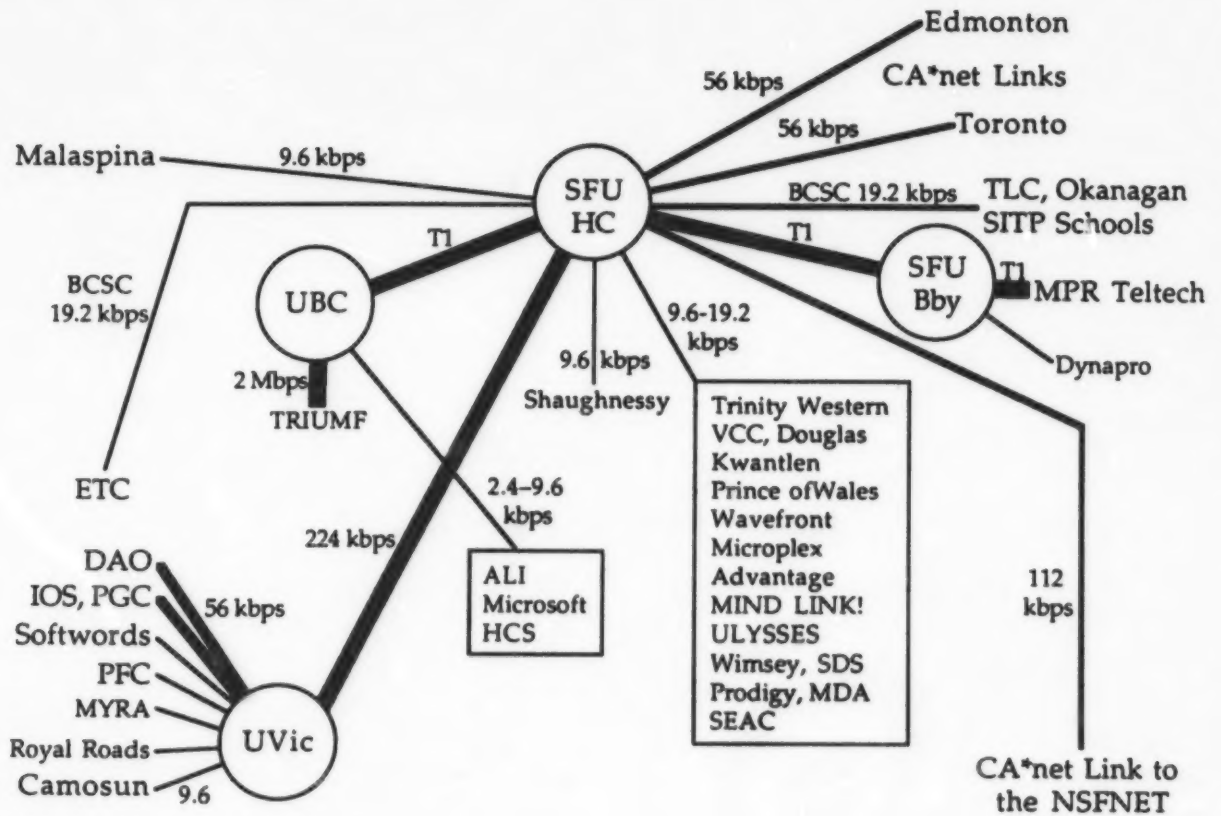
SNA



DNET



BCnet
Current Configuration
 Dec 3, 1991



APPENDIX B
A TELECOMMUNICATIONS PRIMER

This appendix commences with an explanation of the most basic concepts associated with telecommunications, the telephone network and information technology. It then describes some of the important developments currently taking place, before leading the reader to an understanding of some basic data communications concepts. It is not intended to be exhaustive but should at least help the person who is not a specialist in the field to understand the report's general thrust.

Infrastructure, Networks, Services and Applications

Traditionally, there was no difference between the basic telecommunications infrastructure and the telephone network. In fact, this is still the case if we think only of the public telephone network provided by the Telephone Company. This has the following components:

- Customer Premise Equipment - a telephone instrument, FAX, Private Branch Exchange (PBX), or personal computer (with a modem for communicating over the phone line). These devices are almost always customer owned.
- The Local Loop - a connection, usually by copper wire, from the customer premise equipment to a common collection point (the carrier's Central Office).
- The Telephone Exchange - an electronic switch which connects one line to another, at the Central Office, when a call is made.
- The Long Distance Network - microwave, satellite or optical fibre links which connect exchanges together, allowing calls from one area to another.

The major developments over the past twenty years, which have changed the status quo, have been the growth of micro-electronics and the resulting convergence of telecommunications with computing. The processing power of computers is now throughout the infrastructure and has changed it into a multiple use information network. The network is capable of supporting a wide array of special voice, message, data and information *services* in addition to the basic telephone service. Because of the network management capability of computers, the services derived from the infrastructure can belong to any combination of public, private and virtual (shared, quasi-private) networks.

The uses to which an information provider or customer puts the services are referred to as the *applications*. These include many different kinds of electronic mail, electronic bulletin boards, travel reservation systems, text or image filing and retrieval systems, and electronic data interchange (financial, order processing or other computer-to-computer transaction systems). The number of applications is increasing and diversifying all the time.

Private and Competitive Networks

Government agencies and major corporations have, for a long time, operated their own private networks. Although a few (such as BC Hydro and BC Rail) have their own infrastructure facilities, most private networks consist largely of facilities leased from the common carriers but managed privately to suit the operator's own special applications. In British Columbia, the government networks operated by BC Systems Corporation are the prime example.

In addition, the regulatory climate in Canada and elsewhere now increasingly allows competition for the provision of network services. Entrepreneurs have the right to lease infrastructure facilities from the carriers, to "add value" and resell specially tailored services to third party customers. These **Value Added Services** are derived from the basic Telephone Company infrastructure or from a reseller's network, but sold separately at an officially tariffed or competitive price (depending on the specific regulations which apply). Many of these services may be accessed via the telephone.

Resellers develop their own networks by adding computers and other electronics to the leased facilities, in order to meet the special requirements of target markets. The cost savings to users and the new applications thus generated can often bring new growth to the market place and promote the wider take-up of information technology.

What exactly is meant by Digital?

Digital systems involve the simple concept of sending and recognizing coded information. All parts of the telephone infrastructure and related networks are now designed to interact intelligently with one another. Whether we are speaking of telephone exchanges, traffic concentration equipment or long distance transmission systems, the network is rapidly migrating to digital technology - the language of computers.

The previous generation "analog" electronics converted all information, whether it was from voice, facsimile, video or digital data, into complex variable waveforms. These had to be amplified and "repeated" during transmission from place to place. At the receiving end they were "de-modulated" back into their original form. Digital data had to be converted to analog and back into digital format using "modems".

We still use modems to interconnect inherently digital devices to analog facilities such as the local loop, which is the last part of the telephone network to go digital. The *Integrated Services Digital Network (ISDN)*, which the Telephone Companies are introducing later this year, will bring digital format to the local loop and offer customers fully digital service from end to end. The service will allow customers to use the same circuit for voice, fax and a wide range of data applications in a very flexible way. It is described more fully in the report.

Is Everything Going Digital?

Basically, yes. It makes a lot of sense for computers, which now dominate the telecommunications networks themselves and most customer devices, to be able to communicate directly in digital format.

But what about voice and video - aren't they naturally analog technologies? Not necessarily. Voice waveforms and all kinds of pictures or video information can be encoded digitally. The quality of the reproduction depends on the rate at which the signal or image is "sampled" and the degree of sophistication in the encoding and decoding system.

With the rapidly decreasing cost of micro-electronics and the involvement of computers in all aspects of voice and video networks, from telephone exchanges, pagers and voice mail systems to the most sophisticated facsimile, colour image and video conferencing systems, *all* telecommunications applications are thus migrating to digital techniques.

Data Rates and Bandwidths

The data rate or speed of a digital link or device is expressed in bits per second (bps), kilobits per second (kbps) or megabits per second (Mbps). The bandwidth of a communications link refers to the data rate *capacity* of the link. If the link is used for just a single connection (eg. terminal to computer), the bandwidth may be the same as the device using it. If many terminal connections or devices are multiplexed (combined) together, the link's capacity is usually much higher than each individual connection.

We refer to narrowband or wideband (broadband) to describe the requirement or capacity of a particular link. The higher the data rate, the greater the bandwidth. Typical *narrowband* rates used by small businesses for applications such as electronic mail, database access and file transfer are 4.8, 9.6 or 19.2 kbps. These applications use modems to transfer data over analog telephone circuits. Banks and other medium sized business customers use 56 kbps. This rate requires a fully digital service as opposed to a modem connection. The highest data rate still classified as narrowband is 64 kbps, which is the standard data rate to be used by the new ISDN service.

Larger customers use medium data rates such as 1.544 Mbps. This is known as a "T1" channel. Medium rate links are usually expressed as multiples of T1. These links usually carry a number of slower speed connections multiplexed together. Customers who require more than a narrowband link but cannot justify a full T1 can use *fractional T1* circuits, for example $\frac{1}{4}$ T1 (384 kbps) or $\frac{1}{2}$ T1 (768 kbps).

Wideband links cover the range 6 - 150 Mbps or above. These rates are required on routes which carry heavy traffic (eg. a large number of slower speed circuits) or which must support inherently wideband applications, such as high speed computer network

interconnections or full motion video. Planners are talking in terms of Gigabit networks (000's of Mbps) by the mid to late 1990's.

What can data rates do for us?

The higher the data rate on a link, the faster a given application will work, or the more of them we can have on the same link. Bandwidth thus controls the speed of an application or, if we speak in terms of network traffic capacity, the throughput and response time of the network.

How does data rate relate to computer file transfer? Whether they contain text, stored voice messages or images, computer files are sized in digital words (bytes), rather than bits. One byte is equivalent to 8 bits. A single page of text has around 2 kbytes and requires approximately one second for transmission at 19.2 kbps, or 4 seconds at 4.8 kbps. If several terminal connections are combined on the same, slow-speed link, performance will sometimes be much lower than this.

Graphic or picture image files typically have a minimum of 250 kbytes and require several minutes to transmit over a standard modem circuit, whereas at T1 rate they can be transmitted in less than 2 seconds. Geographical Information Systems (GIS) electronic map files usually have several megabytes and require at least a fractional T1 link for effective networking.

Voice connections typically require a 32 or 64 kbps circuit, while live video conferencing currently requires a minimum of 768 kbps ($\frac{1}{4}$ T1). Compression techniques are gradually reducing the bandwidth requirement for voice and video. Systems available today actually allow "picturephone" style video to be transmitted over a 64 kbps circuit, or even less. However, the lower the data rate, the poorer is the system's response to movement.

Computer networks (local area networks) typically operate at a minimum internal speed of 10 Mbps. If interconnection between them is required, they may need transmission links of at least 384 kbps ($\frac{1}{4}$ T1). The most important point here is that computer networks are rapidly increasing their internal data rates. The increasing desire to interconnect them "transparently" is pushing up the data rate requirements on communications links. The BC Government's *Metropolitan Area Network (MAN)* in Victoria has customer connections at 4 Mbps.